The Chemical Age

VOL LXVI 24 MAY 1952 No 1715

Illustration : Acid storage, supported by acid metering house and fume scrubbing tower at a South Wales steelworks.

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Pest Infestation

THE recent DSIR Report urged that special steps at a high level should be taken to remove obstacles in the way of the department's post-war plans, notably those of building. Year by year expenditure upon new buildings and extensions to old ones has lagged behind schedule; no sooner had an agreed annual level of £1 million come within sight (and even at this rate the full programme would take ten years) than there came a severe cut, so that now for 1951/52 an expenditure of £500,000 is doubtful. Set against the total figures of state revenue, a single million pounds is almost insignificant today; the saving represented by reducing it by half is less than significant, the sort of thing that a Chancellor must regard as a triviality. This is not merely petty economy—it is pitifully inverted economy. If we are forced to such a plight as a result of our undertakings in Western re-armament and defence, the inference—be it welcome to the Bevanites or not !—that we are, in fact, weakening rather than strengthening ourselves can be fairly drawn. Surely the real truth is that we are not in such a sorry state that we must deny modern research facilities to vital scientific establishments, and Mr. Butler should see to it that his axe-wielders and pruning-knife manipulators go about their admittedly difficult business with well-informed discrimination.

We are led to these critical remarks by another and more recently issued DSIR Report—that of the Pest Infestation Research Board. Here, too, the handicaps of post-war delay and economy are clearly evidenced. The third sentence begins, 'Bearing in mind present limitations of staff and accommodation . . .' The last sentence, too, returns to the same emphasis—'It is a matter of regret to us that it has not yet been possible to start work on the new laboratories, the plans for which were mentioned in our last report. These buildings are urgently needed and we trust that the start will not be much further delayed.'

Economy by force of general edict is a long-established device of centralisation. It is understandable that the Treasury (or even some over-riding department of economic planning as fondly suggested by the Bevanites) should look upon all state departments as spending departments. At a time when expenditure must be reduced, it is obviously an attractive expedient to insist that all must make similar sacrifice. Nothing disposes more swiftly of the 'not-quite-necessary' than the compulsion of general economy throughout an organisation—this has been proved in industry and commerce and it is unlikely to be any less true of today's vast state administration. Nevertheless, there must be priorities, cases for special treatment.

In an increasingly technical world, in what for Britain is now an increasingly competitive world, can we dare to save on research?

Consider this single case of the Pest Infestation Research Laboratory. It is functioning with few improvements to its pre-war and wartime facilities; but since 1939 there has been a technical revolution in chemical methods of insect control. Furthermore, a new method of research and one of great potentiality in this difficult field has emerged—the use of radio-isotope tracers. These are two obvious reasons why greater facilities must be given if British research is not to lag sorrily behind the efforts of other countries. A third reason is not new; it has always existed, but its urgency has come to the fore more significantly in recent years. With such rapid practical development in new methods of insect control, it has become clear that progress in fundamental knowledge about insects has been slower at any rate; more attention must now be given to basic research to restore a fruitful balance with applied research. Expanded facilities to meet these three requirements have been needed by the Pest Infestation Laboratory since the end of the war. Is it to be said now that the national need for stringent economy must further delay such urgent necessities? This organisation, small enough in comparison with the task it is set, is in the same situation as a boy of twelve still wearing the clothes that fitted him when he was five. Could a domestic economy wave in the home tell him that, like his more fully grown brothers and sisters, he must do without those new clothes for a little while longer?

There may still be a few who suppose that research is a luxury or a gamble and who look upon research workers as favoured holders of care-free state office. The majority of citizens in a country noted for common sense must surely realise that there is nothing wasteful in investing quite considerable sums of money in finding the best ways of minimising losses of stored foods and materials to warehouse or ship-hold insects and their damage by fungi. The long term precariousness of our food situation needs no emphasis today. Can we afford not to develop the best methods for ensuring its safe keeping once it has been gathered together from our own farms or bought preciously from abroad? At the same time it is essential that if new insecticides are used, their residues should not permanently enter the foodstuffs themselves and create toxic hazards. It is with these problems that the Pest Infestation Research Laboratory is concerned and it deals not only with the particular problems of this country, but also with those of the colonies. It is not economy to have money or to save even scarce materials on the long-neglected needs of a scientific establishment whose work is totally directed towards preventing large-scale loss and wastage. It is penny-wisdom and pound-folly and it is to be hoped that the present Government, which from many people derived more support as practical men than as party-political men, will not delay the creation of development priorities for most of our scientific research establishments.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes & Comments

Fluoridisation via Salt?

A MOST important development in fluoridisation has, to say the least, been indicated by research at the University of California Medical Centre. There it has been shown that salt may be as effective a carrier for fluorides as water. If further tests confirm that this is technically valid—and it seems likely that this will indeed be the case—Britain, not yet committed to water supply fluoridisation, could well take early advantage of it. There is nothing novel in the idea of using salt as a carrier of nutritional traces; iodised salt has been long established. Furthermore, the fluoridisation of salt permits freedom of personal choice in this chemotherapeutic method of preventing dental decay. Judging from the progress of water fluoridisation in America—and already from reactions to its suggested introduction here—there will always be a powerful minority vociferously opposed to the addition of fluorides to public water supplies. To that extent an optional carrier seems preferable to an inescapable, and therefore compulsory, carrier. The economics as well as the ethics of fluoridisation would also be eased; for those who wish to follow the fluoride path of dental protection would pay whatever additional costs are involved in fortifying their packets of domestic salt with the additional halide, while those who do not wish to do so would not have to pay additional charges on their water rates.

Centralisation Possible

THERE is a further point of importance. The number of domestic salt producers is far smaller than the number of water undertakings. Fluoride fortification of salt can be technically and economically centralised far more effectively than is possible for water fluoridisation. Even if water fluoridisation is nationally encouraged in Britain at some future date, it would probably be many years before most of the smaller —especially the rural—water supply companies could adopt it. Fluoridised salt, produced in a relatively few factories, could be quickly and nationally distributed, an optional product to be bought across the shop counter.

Tests on Humans Needed

IT is necessary to point out that the evidence for salt fluoridisation is so far limited to animal tests. Groups of young pigs, fed on a high-sugar diet, showed considerable dental decay when ordinary salt was used, but none when fluoride-fortified salt was used. In short, these animal tests have followed the same line as the innumerable tests already carried out with water as the fluoride carrier. Further tests with human subjects are, of course, needed to establish the equivalence of salt as the carrier. In America, it is being suggested that heavy water-drinkers, e.g., workers regularly exposed to heat or people suffering from certain diseases, may suffer from over-dosage with fluorides if public water supplies are made the universal carrier. There is no similar risk if fluoridised salt is developed instead; the person who happens for some reason to be an exceptionally heavy salt-consumer need not buy a fluoridised form of domestic salt. As Britain is about to embark upon her first large-scale test of water fluoridisation, this alternative approach to the same ends—dental protection—would seem to call for urgent and full practical consideration by the Ministry of Health.

Easier Cortisone Synthesis?

THERE are new hopes of reducing the formidable number of reactions in the synthesis of cortisone, and also of using relatively abundant starting materials. The main difficulty is that cortisone synthesis requires the insertion of a keto-group in the number 11 position of a steroid molecule. Most of the more abundant steroid chemicals do not possess this, nor do they possess other groups in that position which could

readily be converted into a keto-group. Desoxycholic acid, one of the original starting materials and obtained from bile acid, possessed the latter attraction. Unfortunately it was a raw material whose supply could never be stepped up to compete with cortisone demand. Several firms have based the synthesis on more easily available steroid substances but the difficult introduction of the keto-group into vegetable steroids like cholesterol or diosgenin or, in one scheme, a steroid substance more liberally obtained from bile acids, has so far increased the number of reactions in the total synthesis. Therefore the gain in production quantity from being able to start with more easily obtained substances has to some extent been offset by the lengthening of an already intricate and cumbersome operation. As is well known, multi-step organic syntheses may be achievable by laboratory or pilot-scale methods, but they are exceedingly difficult to translate into really large-scale production. Cortisone can never become a widely available weapon against disease until these production difficulties are greatly simplified.

Promising Simplification

IT is indeed a promising simplification that has raised new hopes. A microbiological oxidising process, using a mould, greatly facilitates the introduction of a keto-group into the 11-position of the steroid nucleus. A 24-48 hour fermentation produces a new 11-keto-intermediate that can be converted into cortisone. There still remain, of course, the series of reactions formerly needed when the scarce desoxycholic acid was used but now only one major 'jump' is needed to put easily obtainable steroid substances on a par with desoxycholic acid. It remains to be seen whether this new approach can be put into larger-scale action. The research workers (of the Upjohn Co., Kalamazoo, Michigan) claim that a variety of steroids, both vegetable and animal in origin, can be converted into the new intermediate by this mould-directed oxidation.

Sole Rights Obtained

Shell to Manufacture Aldrin

SOLE manufacturing rights of the insecticides, aldrin and dieldrin, hitherto produced by Julius Hyman and Company of Denver, Colorado, U.S.A., have been purchased by Shell, which has also concluded an agreement with the Velsicol Corporation of Chicago for exclusive world-wide rights in these important agricultural chemicals.

Aldrin and dieldrin have been distributed exclusively by Shell in most countries of the world for nearly two years. On 17 March 1952, following lengthy litigation between Hyman and Velsicol, a Court Order granted patent rights on the insecticides to the Velsicol Corporation. Hyman and Company will continue to be operated under its present name and it is expected that in addition to the continued production of aldrin and dieldrin, the development of new and promising products will be accelerated.

A world-wide programme of trial and development of aldrin and dieldrin, carried out by Shell, has confirmed in many countries their unique value for the control of soil insects, cotton pests, locusts and grasshoppers, ants and many other insects. For this purpose dieldrin has been used successfully at only one-eighth of the dosage rate required for DDT.

Aldrin attracted world-wide attention in 1951 when the Iranian Government appealed for help in combating its worst locust plague in 80 years. Thirteen tons of aldrin were flown to Iran and applied at the recommended strength of only 2 oz. per acre. Within 24 hours 98 per cent of the insects were killed.

At the present time aldrin and dieldrin are being manufactured only in the U.S.A., but production in the sterling area is now contemplated.

The terms 'aldrin' and 'dieldrin' were coined from the well-known chemical synthesis, the Diels-Alder reaction. The principal raw material is dicyclopentadiene, which can, of course, be obtained from oil.

Chemically, aldrin contains not less than 95 per cent of 1,2,3,4,10,10-hexachloro-1,4,4a,4,8,8a - hexahydro-1,4,5,8 - dimethanonaphthalene, together with 5 per cent or less of related chlorinated hydrocarbons. Dieldrin contains not less than 85 per cent of 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-dimethanonaphthalene.

The Athabasca Oil Sands

Large-Scale Exploration to Start This Summer

BURIED only a few feet below the surface, in the famous tar sands of Alberta, lie between 100,000,000 and 300,000,000 barrels of untouched oil—an amount eight times as large as the proven oil reserves of the whole of the United States. These sands cover a vast area in beds 100-200 feet thick. Up to now the oil has been unrecoverable for several reasons, but a new process developed by the Mines Branch of the Department of Mines and Technical Surveys has overcome the difficulties and 10 Canadian firms have announced that they intend to start processing the sands on a commercial basis this summer. Permits have already been issued covering 390 square miles, and a core drilling programme to find the areas of greatest oil concentration will now be started. As well as the 10 firms mentioned above, Socony-Vacuum and Sun Oil are also reported to be joining in the first exploratory work. Applications have been placed by them for reservations of 50,000 acres.

Main Problem Solved

Two economic factors have made the Alberta oil sands up to now unattainable—the difficulty of extracting the oil from the sands, and the difficulty of reducing the high sulphur content of the resultant oil. Canadian oil refineries will not accept oil unless it contains less than 0.25 per cent sulphur, and the crude oil obtained from the sands contains up to 4 per cent. It was this problem that was overcome by the research programme conducted by Dr. T. E. Warren of the Canadian Department of Mines and Technical Surveys. Basically, the process consists of hydrogenation under conditions of temperature and pressure, which reduces the sulphur content of the feedstock to less than 0.2 per cent. So far the apparatus has only been constructed on a laboratory scale, but a larger apparatus is under construction for the investigation of the high pressure range of operation, to ascertain optimum conditions for the process. This will be capable of operating at 20,000 p.s.i., and is expected to be ready by this summer.

The extraction of the oil from the sand was made possible some time ago. S. M. Blair, Alberta Government consultant, reported that a profit could be made out of extracting the oil by mining the sand. In the Blair Report he estimated that it would cost 55 cents (4s.) a barrel to mine the sands and deliver them to the processing plant. Processing costs were put by him at 72 cents (5s.) a barrel, making a total of $1.27 a barrel. However, a Swedish oil company (Swedish Shale Oil Co.) is reported to have a process for recovering the oil without the necessity of mining the sand. This company has arranged with the Government to carry on work with this process and has leased part of the Government's pilot plant at Bitumont, Alberta, for $25,000 (£9,233).

Development Flexible

Whichever process is finally used, technical development is now definitely feasible. Greatly assisting the practical economic problems of this development has been the recent oil boom that has been going on in Alberta for the last five years. At the beginning of 1947, when the Leduc oil strike was made, Alberta was hardly producing enough oil to satisfy her own requirements. Conditions were such that companies were considering the possibility of making synthetic gasoline from natural gas, and some had started to look for natural gas with this in mind. Since that time, 17 new oil fields have been discovered, and 13 other areas have yielded oil. Up to the end of 1950, 3,926 wells had been drilled, with 1,000 drilled during that year alone, an average of over two wells per day being brought into production, to bring the total number of operating wells to 3,000. Now, over 150 geophysical crews are at work in the province, with 140 drilling rigs and 50 drilling companies working. Alberta serves 40 per cent of the whole of Canada's needs.

Other aspects of this enormous increase in Alberta's exploitation of her oil can be seen from her production figures. In 1950, 27,500,000 barrels were produced, four times as many as in 1947. Over 10,000 leases cover 9,000 square miles, and in addition there are over 360 reservations covering 62,500 square miles. Money is being spent in Alberta at a fabulous rate. Purely on searching for

oil and producing it, $36,000,000 (roughly £13,000,000) were spent in 1947, rising to $200,000,000 (approximately £70,000,000) in 1951. This vast sum does not include money spent on refineries, transport, etc.

The desulphurisation process which is going to make the Athabasca tar sands a commercial proposition has been described in *Canadian Chemical Processing*. The experimental work on this was done on bitumen obtained from sand from the Horse River area. The bitumen is separated from the sand by the cold-water method, and water and diluent removed from the separated bitumen by quench distillation (the heat being supplied by superheated vapour or gas). The bitumen is distilled to coke, in a quench-heated still, and in order to remove a small amount of fine solid material, the oil is filtered through a bed of glass wool supported on a 100-mesh screen.

Cobalt Molybdate Catalyst Used

The coker distillate as charged is a heavy black oil having a sulphur content of 3.5 per cent and a specific gravity of 0.936 (19.7° A.P.I.). The catalyst used is cobalt molybdate supported on an aluminium base.

The function of the apparatus is to pass hydrogen and the liquid oil through a vertical bed of catalyst at controlled temperatures, pressure and feed rates. The main pieces of high pressure equipment used are a feed vessel, a vertical cylindrical reaction chamber with heater, a water-cooled condenser, and a liquid product receiver. These are arranged in vertical sequence to permit gravity flow of liquid.

The measured liquid oil feed is first charged to the 18-8 type stainless steel feed vessel, made of 3-inch extra-strong pipe. This is approximately 2⅞ in. inside diameter and 12½ in. inside length, using stainless steel lens ring closures at both flanged ends. With the hydrogen pressure balanced above and below the liquid in the feed vessel, the liquids flows down by gravity. The liquid feed rate is controlled by regulating its passage through a needle valve, and is estimated during operation by counting drops passing through a sight glass from a shaped dropper.

The hydrogen feed is obtained in standard commercial cylinders containing the equivalent of 180 cu. ft. of gas at atmospheric pressure and room temperature. When full, the cylinder pressure is approximately 2,000 lb. per sq. in. The desired operating pressure is obtained by setting a pressure regulating diaphragm valve at the cylinder, which maintains the pressure constant at a reduced value. The pressure is measured with a Bourdon-type gauge with a range from zero to 8,000 lb. per sq. in.

The hydrogen feed rate is controlled by the rate of release at the outlet end of the system. An instantaneous indication of the hydrogen feed rate is obtained from a high-pressure flowmeter of the rotameter type which has been calibrated for various pressures. The hydrogen feed and the liquid feed pass down through vertical tubing and meet at the top of the reaction chamber. This chamber contains a stainless steel thermocouple well of ¼ in. outside diameter tubing with 20-gauge wall thickness, inserted in the bottom or outlet end and extending centrally through the length to the inlet end. The catalyst pellets are contained in the annular space between the thermocouple well and the inside wall of the chamber. They are supported by a retainer ring with drilled passages which fits over the thermocouple well tube and is in turn supported by a formed piece of 1/16 in. diameter stainless steel rod extending to the bottom of the reaction space. Fifty ml. of the pelleted catalyst occupy a length of approximately 13½ in.

The desired temperature is obtained from the electric tube furnace, and is maintained by a recorder-controller of the potentiometer type operating a magnetic switch in series with the furnace-heating element.

The hydrogenated products flow downward from the reaction chamber through a condenser coil immersed in a cold water bath. From the condenser the products enter a receiver which is the same as the feed vessel. The liquid product accumulates here and may be drained off through a needle valve.

Excess Passed Off

The excess hydrogen and uncondensed gases pass off from the top of the product receiver continuously through another needle valve, the rate of release being used to control the hydrogen feed rate. The rate of flow of these exit gases is constantly checked as they pass through a wet test meter, measuring 1/10 cu. ft. per revolution at atmospheric pressure. The meter is protected from accidental over-pressure by a water-filled surge pot. With this arrangement of

apparatus the exit gases are exhausted to the atmosphere and consequently wasted, but in actual large-scale practice they would be recirculated.

To commence a run, the electric furnace is switched on. When the desired operating temperature has been reached and stabilised, the hydrogen gas flow rate is adjusted, and then the liquid feed flow is started and set at the desired rate. Although the rotameter gives an indication of the hydrogen flow rate, the final figures recorded are for the exit gas rate as obtained from the wet test meter at atmospheric pressure. In determining the hydrogen feed as cubic feet per hour and cubic feet per barrel of liquid feed, it has been assumed that the volume of the uncondensed gases is the same as the volume of the inlet hydrogen.

The liquid feed rate is indicated by the number of drops passing through the sight glass. To facilitate obtaining the desired number of milliliters per hour, a relationship between these quantities was established, with correction factors for the pressure and the rate. With feeds of varying viscosity, it is necessary to determine an additional correction factor. In the calculations, the average liquid feed rate is obtained from the total volume of feed and the elapsed time. The hydrogen cylinder pressure is recorded, as well as the operating pressure. The former is used in the calculations of hydrogen consumption to determine the actual amount of hydrogen fed without introducing the aforementioned approximation.

Preventing Contamination

To prevent residue from a previous run from contaminating samples, the preliminary liquid product is withdrawn after the first half-hour of feeding. It is then measured and discarded. Following completion of the liquid feed, the operating conditions are continued for one half-hour to allow the apparatus to drain before completion of the liquid product.

This latter sample is used to obtain the specific gravity, which is determined by a Westphal chainomatic specific gravity balance, and to obtain the sulphur content, which is determined by the A.S.T.M. bomb method. In addition, the weight of this sample is combined with that of the preliminary product to obtain the weight yield. The volume yield used is based on the weight yield and specific gravity.

In calculating the hydrogen consumption, the volume of hydrogen input is calculated from the hydrogen cylinder pressures at the start and finish of the liquid feeding period, and is based on a cylinder volume of 1.58 cu. ft.

An interesting by-product of this process will be the sulphur removed from the tar sands by the desulphurisation process, which promises to be accomplished in marketable quantities.

Licensing Proposal

U.S. Firms Seek U.K. Contacts

SEVERAL chemical and allied products are included in the licensing proposals for the foreign manufacture of the products of 33 American companies announced by the Mutual Security Agency Mission to the United Kingdom.

This is the sixth compilation of specific licensing proposals made by U.S. manufacturers and issued under the licensing programme begun by the Marshall Plan organisation and now continued by MSA. The licensing programme was established to effect contacts between European and American firms interested in entering into licensing, or partnership, arrangements for their mutual benefit. Subsequent negotiations are carried on between the firms through ordinary business procedures.

In the U.K., officers of the following are acting as Field Counsellors: Associated British Chambers of Commerce, Federation of British Industries, Scottish Council (Development and Industry), and the Ministry of Commerce, Northern Ireland.

The list included the following proposals:

No. 197, R. S. Aries & Associates of New York, would like to license European firms for the manufacture of its chemical products.

No. 216, Polyplastex United Inc., of Bronx, New York, is interested in licensing a European firm for the manufacture of their fibre glass and plastic.

No. 221, The Stepan Chemical Co., of Chicago, Illinois, is interested in licensing European firms for the manufacture of their synthetic detergents.

No. 222, Louis J. Urland, of Chicago, Illinois, would like to license a European firm for the production of their agricultural pesticides.

Action Against I.C.I. Fails

Conspiracy Not Proved

AFTER an absence lasting two hours, a jury in the Queen's Bench Division on 13 May, found for the defendants in the case brought by Dr. Hubert Bagster Trumper, of Cusop, Hay-on-Wye, Herefordshire. Dr. Trumper alleged that Imperial Chemical Industries and three of its officials had conspired to injure him. He claimed damages from I.C.I., Dr. James Armit, the head of its Wilton (Middlesbrough) factory, and Mr. Harold Octavius Smith, of Mattingly Lodge, near Basingstoke, and Dr. Cecil John Turrell Cronshaw, of Alnwick, Prestwich Park, Manchester, personnel directors of the company.

Mr. Justice Lynskey entered judgment accordingly with costs, and then said, 'The jury have passed a note to me and they want it included in their verdict.' He read:

'We bring a verdict of not guilty only because we have failed to find evidence that either Mr. Smith or Dr. Cronshaw have shared in Dr. Armit's obvious intent to cause injury to the plaintiff.'

Board Makes Statement

Imperial Chemical Industries later issued the following statement:—

The board of directors of I.C.I. Ltd., have had their attention drawn to the fact that after judgment with costs had been delivered against Dr. Trumper in favour of the company and the other defendants, Dr. Armit, Dr. Cronshaw and Mr. Smith, a rider by the jury contained observations on the conduct of Dr. Armit. The board have been advised that since the rider formed no part of the judgment or verdict, it is not possible to appeal against it to the Court of Appeal as would otherwise have been done.

The plaintiff alleged that the defendants had conspired together to deprive him of his employment and prospects of advancement. In 1946 he had been appointed as personnel manager at a new plant which was being erected at the company's Wilton works, Middlesbrough, for the production of α-naphthylamine. He alleged that he had been victimised because he had expressed his anxiety that the design of the plant would not give sufficient protection to workers coming into contact with the substance, which was suspected of being causally connected with the development of cancer of the bladder. He alleged further that Dr. Armit had warned him that if he persisted in his criticisms his position with the company would be endangered. He said that he had persisted in his criticism; and his employment was terminated on 3 August, 1949.

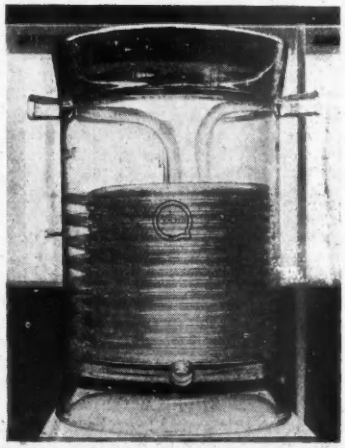
The defendants admitted that the plaintiff's employment had been terminated, but they denied all the other allegations.

During the hearing Mr. Melford Stevenson, Q.C., conceded on behalf of the plaintiff that the α-naphthylamine plant at Wilton was as safe as human skill and care could make it.

Interchangeable Exchanger

WHAT is claimed as the world's largest standard interchangeable heat-exchanger unit was exhibited for the first time at the British Industries Fair at Olympia, London, by Quickfit & Quartz, Ltd., manufacturers of scientific and industrial glassware of Stone, Staffs. The heat exchanger is designed for incorporation in 18-inch diameter HCl absorption columns.

Also displayed on the 'Q. & Q.' stand was a continuous distillation unit. Over 30 feet high, this was one of the outstanding exhibits at Olympia. It included a 200-litre flask and 18-inch diameter glass pipeline, both said to be the largest items of their type in regular production. The unit on view had been designed specifically for double distillation of water, including preparation of pure water for medical work.



The interchangeable heat exchanger

Non-Catalytic Fluidisation

Value of the Process in Calcination & Other Fields

FLUIDISATION came into its own during the war, when the Standard Oil Development Co. pioneered the use of this technique in petroleum refining, as a means of promoting intimate contact between the catalyst and the reacting oil vapours. Essentially, this now well-known process consists of maintaining a mass of finely divided solids in a turbulent, dense state by dispersion in an upward-moving gas stream, which imparts to the mass a turbulence resembling that of a boiling liquid.

The value of this new technique for non-catalytic processes was quickly recognised, the only important consideration limiting its potential applications being that the intended reaction must be effected at temperatures which do not soften or fuse the solids during treatment. The Dorr Company has successfully developed a number of applications in the chemical, metallurgical and mining fields. This novel technique has recently been introduced to Britain by the Dorr-Oliver Co., Ltd., whose association with the well-known Dorr Classifiers and Thickeners goes back for many years. The British company has erected a pilot plant in Surrey for the new 'FluoSolids' process, for which equipment of British manufacture can now be obtained.

Differences in Technique

Applied to non-catalytic operations, the fluidisation technique differs in important respects from the methods developed for the 'fluid-solid' catalyst production of high octane gasoline. In catalytic operations the solid phase particle size can usually be selected for optimum fluidisation. Except for dust losses and make-up, the solids are recycled within the system. If the catalysis is endothermic, the heat can usually be supplied in the form of sensible heat contained in the catalyst and in the gas phase hydrocarbons. In most non-catalytic operations, however, the solid phase particle size distribution is governed either by the preceding or subsequent operations or by economic considerations. Another difference is that the solids and the gas pass through the system only once and heat or controlled atmosphere must usually be produced within the fluid bed of solids. However, many operations are carried out at temperatures higher than those encountered in catalytic fluidisation. A final consideration is the importance of heat economy, which demands the use of counter-current heat transfer, preferably in fluid beds. These factors have profoundly influenced the design of equipment for non-catalytic operations.

Accurate Control Achieved

An outstanding advantage of fluidisation is the very accurate control which is achieved over conditions in the reactor. Bed temperature is uniform, as measured by thermocouples at various points, and can be controlled with an accuracy of ± 10-20°F. This very rigid control is possible because the mass of solids within the fluid bed are being continually and thoroughly mixed. It is characteristic of a fluid bed that a very rapid and random motion is imparted to individual particles which results in an extremely rapid transfer of heat from one portion of the bed to another. As an illustration of this rapid heat transfer it has been found that in the case of roasting pyrites, a large excess of heat is produced which can be absorbed by the evaporation of a water stream injected at one point in a 16 ft.-diameter fluid bed without experiencing an appreciable temperature difference between various points of the fluid bed. Similarly, the composition of the gas phase can be very closely controlled, an advantage which is important in simple calcination operations and still more so in controlled reductions.

The system is continuous and fully instrumented, and capable of treating a wide range of particle size in the raw material. The absence of moving parts, exposed to high temperature inside the reactor, coupled with exceptional refractory life, have very favourable effects on maintenance costs, while operating costs are also low. Once operators have become accustomed to the equipment and its controls, little attention is required beyond ensuring a supply of feed and air and the disposal of the treated product.

The principal limitation is that under certain conditions the solids in the bed

become sticky and fluidisation gradually stops. Situations have been encountered in which surface adhesion resulted in the entire fluid bed becoming static and immobile. Another partial limitation concerns the operating rate. Since the minimum and maximum gas velocities for good fluidisation are, respectively, 75 per cent and 125 per cent of designed capacity, the operating rate should, as a general rule, be kept within these limits. However, in certain selected instances it has been shown that it is possible to exceed these limits very materially. Despite these limitations the potential field for the process is extremely wide.

Applications Being Developed

Many non-catalytic applications of fluidisation are being developed, some of which have already been established commercially while others are in the pilot-plant stage or have yet to be piloted. Among the types of operations which have proved responsive to fluidisation are the following: calcination of limestone, dolomite, metal hydrates, etc.; partial calcination, oxidation, particularly when it can be accomplished at high temperatures; reduction of metallic oxides such as the reduction of hematite to magnetite; roasting of arseno-pyrites and sulphides of zinc, copper and iron; chlorination, including volatilisation of metallic chlorides; heat transfer operations wherein sensible heat is transferred from solid to gas phase or the reverse; production of high concentration sulphur dioxide for the manufacture of acid or liquid sulphur dioxide; and continuous drying of granular non-metallic minerals.

In some types of application efficient heat exchange is achieved by the use of reactors having several compartments one above the other. The fluidised solids overflow down transfer pipes between compartments. The hot gases pass from the calcining compartment and travel upwards, fluidising each compartment in turn and giving up more and more of their sensible heat to the incoming raw feed. Similarly, the hot calcine flows into the lower, cooling compartment, where it is cooled by incoming cold air. This air is, in turn, preheated before it enters the calcining compartment. Multi-compartment reactors of this type are being used, *inter alia*, for the calcination of lime, and have been piloted for the magnetic roasting of iron ore.

A simpler form of reactor is a single-compartment unit, which has been used in Canada for three or four years for roasting arsenical gold ores. When the precious metal in finely divided form is embedded in arseno-pyrite or pyrite it cannot be won by treatment with cyanide until either the arsenic, or the sulphur, or both, have been removed by oxidation. At Cochenour Willans Gold Mines, Ltd., McKenzie Island, Ontario, a Dorrco 'FluoSolids' reactor is roasting a flotation concentrate containing arseno-pyrite, pyrite, stibnite, small quantities of other sulphides, and some lime silicates and carbonates, yielding a calcine which is readily amenable to cyanide treatment. The introduction of a flotation and 'FuoSolids' section has increased the total gold recovery from 78.6 to over 95 per cent. As a result of this successful initial installation, two other gold properties in Canada and one in the U.S.A. are now operating 'FluoSolids' roasters. In addition two more are being constructed in Canada.

In these simpler one-compartment units the sulphide concentrates furnish all the heat required for roasting; in fact with most sulphide concentrates there is an excess of heat. Feeding is quite simple, it having been demonstrated that a heavy slurry, 75-80 per cent solids by weight, can be pumped into the reactor as a liquid stream. This eliminates troublesome drying problems and permits accurate control of the feeding rate so that it may be kept proportional to the air volume. Having at hand complete control over both the feed rate and air rate, it is thus possible to roast under a variety of conditions so that theoretical gas strength (14-15 per cent SO_2 in the case of pyrite) may be realised if desirable; also the system permits roasting to various degrees of oxidation in the residual calcine, a fact which is of importance where the calcine is to be sintered, and residual sulphur furnishes fuel for this step.

Three Basic Problems

The application of fluidisation to limestone calcination is extremely interesting because three basic problems were involved. In the first place a crystalline stone had to be completely calcined to produce a high-grade chemical and plaster lime of good colour. Secondly, the fuel available was a fuel oil, which had to be burnt in a fluidised bed without discolouring the final product. Finally, heat recovery from both the lime

product and the stack gas was necessary, so that heat transfer fluid beds had to be provided in addition to the calcining fluid bed.

This project was initiated by The Dorr Company in 1944 and culminated in the successful development of a new process at the works of the New England Lime Co., Adams, Mass., U.S.A. The pilot plant had three superimposed fluid beds. The top bed was charged with limestone, crushed and sized to minus 6 plus 100 mesh, for preheating to about 1,100°F. Preheated stone was transferred in the fluidised state down a transfer tube to the central calcining compartment, usually operated in the 1,700-1,750°F. range. Due to displacement by incoming material, the burnt lime was transferred down to the bottom compartment, where it preheated the incoming combustion air as it cooled. The lime was discharged at a temperature of 500-550°F. The gas phase flow was countercurrent throughout, and the cross-section of each compartment was designed to maintain the optimum space rate under the conditions prevailing in each compartment.

Fuel oil is forced into the fluid bed of the calcining compartment through a radial pipe projecting several inches into the fluid bed. Each fuel injector is supplied by a positive displacement pump with a definite volume of fuel oil. Since all combustion air enters through the bottom in controlled volume, and, after preheating, goes into the calcining compartment where it contacts the fuel in controlled amount, the conditions for combustion prove to be entirely sound. Operating temperatures of 1,700-1,750°F. in the calcining bed produce a lime with less than 1 per cent CO_2 content, and with chemical availabilities of 98 per cent of the maximum possible. Fuel consumption in the pilot furnace averaged 43 gallons of oil per ton of burned lime.

Passage of Limestone

After the pilot installation had been in operation for about a year, the passage of the limestone through the reactor was reported to be so easy and burning so 'soft', that in many cases the original physical structural characteristics of the limestone were retained in the lime. The wear and tear on the brickwork and the 'constriction plates' was very small, ordinary fire-clay brick lining being almost as good as new after 11 months of intermittent use.

On the basis of the experience gained in the operation of the 5 ft. by 26 ft. pilot reactor, designed for a capacity of 8½ tons per 24-hour day, designs were drawn up for a similar reactor having a capacity of 100 tons per day. This commercial unit has now been in operation for over two years and has fulfilled the economic expectations based on the pilot plant. High quality lime is being produced daily with only 33 U.S. gallons of fuel oil per ton of product, a saving of about 40 per cent over the more conventional rotary kilns in use at the same plant. In its commercial embodiment the unit consists of a steel tower roughly 13 ft. in diameter by 45 ft. high, lined with refractory and separated into five compartments by refractory arches. The top three compartments are heat-exchanging fluid beds, which preheat the incoming limestone and cool the hot gases from the fourth, or calcining, compartment. Below the calciner the lower compartment cools the outgoing product. This installation is highly instrumented and requires a minimum of operating attention. Maintenance has been negligible to date.

Much Work to be Done

Much work has got to be done on a variety of limestone, using fuels other than oil, before the full value of the process to the lime industry can be reliably assessed.

Several industries produce as a by-product precipitated calcium carbonate, which must be recalcined to lime for either economic or disposal reasons. In the case of the water-softening industry, the precipitate is usually, but not always, a mixture of calcium carbonate and magnesium hydroxide. Following lime precipitation and further treatment, a relatively pure calcium carbonate is obtained for recalcination and re-use. The filter cake is then dried in a Raymond flash dryer and calcined. Special features of interest are presented by a 'FluoSolid' kiln developed for this particular operation.

In this application the solids being fluidised are usually finer than 50 microns and have a fairly uniform particle size distribution. The gas velocity for dense phase fluidisation of material of this type is relatively low, being approximately 0.5 ft. per second. It was evident, therefore, that the capacity of a conventional fluidisation plant, as measured by oxygen input, would be low. Moreover, calcination of such fine material must yield a product which would constitute

a dust nuisance and a health hazard, besides being extremely difficult to handle in storage and conventional feeders.

These difficulties were overcome by the discovery that the addition of a small amount of soda ash, or some other suitable alkali, in conjunction with the turbulence of the fluid bed, formed the calcined lime into hard round pellets. These pellets are formed and the lime is calcined at a temperature not exceeding 1,850°F., so that the product could not be regarded as a hard-burned lime. There are indications, however, that it is a well-burned lime as measured by the usual 'activity' and available lime analyses, taking into consideration the character of the raw material. A 5-ton-per-day pilot plant for the production of calcined lime pellets has been successfully operated and a commercial unit is now being designed.

In the normal application of fluidisation, dust entrainment is merely a nuisance. In a unit that dries and sizes the feed for two rotary kilns of the New England Lime Company at Canaan, Connecticut, it is a desirable feature of the process. This sizer-dryer uses hot air to evaporate the moisture and sizes the feed by differential entrainment from a fluidised bed. This unit is continuously drying and sizing up to 50 tons per hour of -4 mesh dolomite of variable moisture content. The removal and recovery of marketable fines from the feed give an improved product and effect a fuel saving in the kiln operation. For 2 per cent water feed entering at 18°C., drying air enters at 400°C., dry sized product leaves at 110°C. and 0.02 per cent water and moist dustladen air leaves at 75°C. The air is heated by an oil burner using No. 2 fuel oil at a rate of one gallon per ton of feed; 8,000 cu. ft of free air compressed to 1.2 p.s.i. gauge are required per ton of feed.

Among other major applications for fluidisation on a commercial scale are copper sulphide roasting for smelting or sulphating roast, zinc roasting for retort smelting of electrolytic zinc, and the roasting of pyrite for the production of blast furnace or open hearth sinter.

POLYTHENE CONTAINERS

Testing the toughness of polythene containers made by Cascelloid, Ltd., of Leicester. Above: A bottle squashed, but unbroken under a car wheel. Left: Dropping bottles from a height and watching them bounce. Although they may be scratched, they survive this test otherwise undamaged. Polythene containers save weight, space, and are easy to handle, and are suitable for a variety of chemicals over a wide range of temperatures (see THE CHEMICAL AGE, vol. 66, p. 593)

Standard Hydrocarbons for Industry

CRL Distributes Wide Range of Samples

MODERN methods of analysis, such as those involving ultra-violet, infra-red and mass spectra, depend upon the availability of pure standards of the components being examined. It is only since the war that the expansion of petroleum refining has created a demand in this country for mass spectrometers, but these instruments are now being extensively used by the petroleum industry and their manufacture is undertaken by a British firm. These developments have made it necessary that standard hydrocarbons of certified purity should be available. A hydrocarbon sample is suitable for calibrating mass spectrometers only if it is of such a purity that further chemical purification produces no observable change in the cracking pattern, and provided that the distribution of isotopic atoms in the molecules is normal.

Scheme for Standard Samples

In 1949, the Chemical Research Laboratory was asked by the Hydrocarbon Research Group of the Institute of Petroleum to inaugurate a scheme for the procurement and distribution of a range of standard samples. Eighty-four samples of 29 different liquid hydrocarbons were therefore obtained from the U.S. National Bureau of Standards by the CRL for distribution to other laboratories. In addition, supplies of standard gaseous hydrocarbons were secured and samples transferred to glass ampoules for the convenience of users. Since the expansion of the petroleum and chemical industries and the development of new methods and processes must increase the demand for these standards, it was considered desirable than an indigenous source of supply should be developed and that the range should be capable of extension to meet any new requirements which might arise. A prominent position in the research programme was therefore accorded to the preparation of pure substances and the accurate determination of the physical and physico-chemical data. A low temperature still for the preparation of pure hydrocarbons was constructed at the CRL, another new still with a spinning band fractionating column being installed for the purification of long-chain fatty acid compounds.

About a third of the samples distributed are now prepared entirely at Teddington, and it is anticipated that eventually the CRL will supply all of them from its own production. So far about 500 ampoules have been distributed to Government, university and industrial laboratories in Great Britain and overseas. Each request involves a considerable amount of work. Standard samples of the following organic substances are at present available:—

Substance	*Mol. per cent purity*
Methane	99.84 ± 0.03
Ethane	100.00
Propane	99.99 +
n-Butane	99.78 ± 0.08
iso-Butane	99.88 ± 0.06
n-Pentane	99.88 ± 0.06
2 : 2-Dimethyl propane	99.83 ± 0.03
n-Hexane	99.85 ± 0.05
2-Methyl pentane	99.82 ± 0.05
2 : 2-Dimethyl butane	99.93 ± 0.03
2 : 3-Dimethyl butane	99.74 ± 0.06
n-Decane	99.73 ± 0.02
Cyclopentane	99.95 ± 0.01
Cyclohexane	99.99 ± 0.005
Ethylene	100.00
Propylene	99.72 ± 0.02
Butene-1	99.88 ± 0.20
2-Methyl Propylene	99.44 ± 0.09
cis-Butene-2	99.74 ± 0.10
trans-Butene-2	99.32 ± 0.08
2-Methyl-butene-2	99.66 ± 0.05
Hexene-1	99.22 ± 0.10
Cyclopentene	99.97 ± 0.02
1 : 3-Butadiene	99.87 ± 0.05
2-Methyl-1 : 3-butadiene	99.80 ± 0.04
Benzene	99.99 ± 0.005
Toluene	99.98 ± 0.01
o-Xylene	99.95 ± 0.02
p-Xylene	99.98 ± 0.01
m-Xylene	99.97 ± 0.02
β-Picoline	99.71 ± 0.14
α-Picoline	99.77 ± 0.11
2 : 6-Lutidine	99.85 ± 0.07

Suitable material for the preparation of pure samples of the normal paraffins C_5 to C_9 has been obtained and separation of the constituents is in progress.

Containers for Hydrocarbons

The hydrocarbons are supplied in pyrex glass ampoules fitted with break-tip seals. Each ampoule is numbered and is accompanied by a certificate of purity as established by a suitable technique (e.g., by freez-

ing point determination or by mass spectrometry). The gaseous hydrocarbons are sold in ampoules of approximately 500 ml. vith the gas at atmospheric pressure, the liquid ones in ampoules containing 5 ml. A special feature of the ampoules is that they are designed for vacuum manipulation. They are sealed *in vacuo* and the break tips seals allow them to be sealed on to a vacuum system and transferred without coming into contact with air. Instructions for transferring *in vacuo* are issued with each sample.

IN THE EDITOR'S POST

Fluoridisation of Water

SIR,—During our researches into the fluoridisation of water in the U.S.A. we have read the following:

Recent research from the University of Texas Biochemical Institute suggests that while sodium fluoride does not cause cancer it definitely accelerates the growth of mammary cancer in female mice. Experiments will continue for at least two more years under conditions of rigid control before a definite and final announcement is made. Officials cognisant of the preliminary findings say they have kept the matter behind closed doors for fear of a public panic. (*Times Standard*, San Angelo, Texas, 7 May, 1951).

Extracts from a letter in the U.S. *Catholic Mirror*, January, 1952, from Dr. E. H. Bronner, manufacturing research chemist, of Los Angeles:

'Fluoridisation of drinking water is criminal insanity. Even in small quantities sodium fluoride is a deadly poison to which no effective antidote has been found. Sodium fluoride is entirely different from organic calcium-fluoro-phosphate needed by our bodies and provided by nature to build and strengthen our bones and teeth. This organic calcium-fluoro-phosphate derived from proper foods is an edible organic salt, insoluble in water and assimilable by the human body whereas the "unorganic" sodium fluoride used in fluoridisating water is instant poison to the body and fully water-soluble. The body refuses to assimilate it . . . . We know that a powerful and favourite weapon of any plotting enemy for mass liquidation of population is the poisoning of drinking water systems. Its use has been recorded in other countries. In over 125 cities in the U.S.A. fluoridisation equipment is already installed. One turn on one valve by one traitor in each city and millions of citizens will be quickly paralysed from fluorine poisoned water . . . Remember—atom bombs would destroy everything—fluorine-poisoned water only the people, leaving intact for the enemy all the loot.

Dr. A. L. Miller, of the Select Committee on Chemicals in Foods and Cosmetics, the U.S.A., who was originally in favour of fluoridisation of water supplies, reversed his opinion after the recent hearings on the subject which were due for publication on 1 May, 1952.

Is there any wonder we housewives are worried lest scientists should decide on fluoridisation of British water supplies?

WINIFRED M. SYKES.
Vice-chairman, British Housewives League.

Editor's note: *Mrs. Sykes has no cause for alarm. The innocuous nature of fluorine in concentrations which will reduce dental caries has been definitely proved and the opinions she mentions are not to be taken seriously. Work on the subject has been carried out on three continents for more than 30 years. It is recommended that the concentration of fluorine in water should not exceed 1 p.p.m. and this can be easily and most accurately regulated. Mrs. Sykes should remember that water in many areas contains natural concentrations many times higher than this. In Maldon the water contains 5 p.p.m., in West Hartlepool 2 p.p.m., and in India and Africa the concentration is sometimes as high as 11 p.p.m. Millions of people in the United States are served by water supplies naturally containing a fluoride ion content of over 1 p.p.m. and in some of these cases the content is over 5 p.p.m. Mrs. Sykes should realise that the chemist and physician aims at prolonging life, not shortening it. If anything were advocated which might endanger health or life they are first who would object and they are the people who know all of the facts—not just a few half-truths. Many things which are highly beneficial in small quantities are harmful or dangerous in large doses (strychnine is one of them). As to poisoning of water supplies by an enemy, fluorides have nothing on bacteria such as typhus or cholera, since they are not catching. Moreover fluoridisation equipment does have ways of testing the water for excess doses.*

New Aspects of Alkylation Processes

Improvements Emerging from the Last Five Years

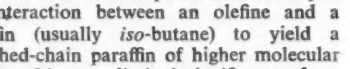
THE increased demand for aviation fuel during recent months has brought with it renewed interest in alkylation processes. The need for large amounts of alkylate is further intensified by the new high octane number required by present engine design. Thus, an octane number of 100/130, which was top-grade during the days of World War II, is no longer satisfactory. The bid demand today is for 115/145 aviation petrol.

To produce fuel of this rating, 70-80 per cent alkylate must be used for the blend, a substantial increase over the 25-35 per cent alkylate content of the top fuels of the last war.

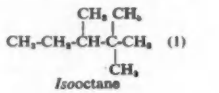
As far as processes are concerned, the refining industry finds itself prepared for its new task. Significant improvements in alkylation technique have come out of the laboratories and pilot plants during the last five years. To boost production, old alkylation units which have been idle since 1945 are being revived and new plants are being constructed. Important among new units are the 2,000 b.b.l./day plant of California Refining Company which was recently taken on stream, and the expanded alkylation facilities now under construction at Gulf Oil Company's Arthur refinery.

The term 'alkylation' as used today encompasses the entire field of reactions in which an alkyl group is substituted for the hydrogen of an organic compound. Of immediate interest to the petroleum industry is the interaction between an olefine and a paraffin (usually *iso*-butane) to yield a branched-chain paraffin of higher molecular weight. Of more limited significance, from the refiner's point of view at least, is the production of alkylated aromatics such as cumene (*iso*propyl benzene), a hydrocarbon characterised by outstandingly high octane number as well as by high unit cost.

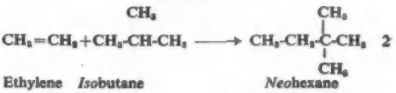
While the reaction mechanism differs in the various alkylation processes employed today, the overall reactions involved are illustrated by the following equations:



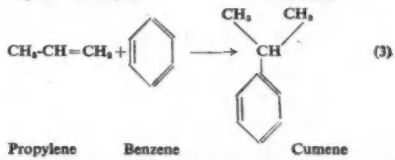
Butene-(1) *Iso*butane



*Iso*octane (1)



Ethylene *Iso*butane *Neo*hexane (2)



Propylene Benzene Cumene (3)

Three types of alkylation process are of primary interest to the petroleum industry. These are thermal alkylation, hydrofluoric acid alkylation, and 'cold acid' (sulphuric-acid-catalysed) alkylation.

Thermal alkylation is carried out at temperatures just below cracking range (900-1,000°F.) and at elevated pressures (up to 5,000 p.s.i.). In order to minimise the tendency of the olefinic components of the charge stock to polymerise under these conditions, it is necessary to use a high ratio of paraffin to olefine. Thus, work by the Phillips Petroleum Company has shown that formation of heavy polymer in the production of *neo*-hexane is eight times greater for an *iso*paraffin: olefine ratio of 3:1 than for a ratio of 8:1, other conditions being equal.

Thermal alkylation is suitable for use with lower olefines, notably ethylene. The reaction with C_4 and higher olefines is too sluggish to be of commercial interest. Only one commercial plant, based on the thermal process, has come to the author's attention. This unit was originally taken on stream in late 1942 for the production of *neo*hexane. More highly selective catalytic processes, operated with milder conditions, have since relegated interest in thermal alkylation to a minor status.

From the point of view of volume production, 'cold acid' alkylation is by far the most important process of this type today. The process is carried out at slightly above

atmospheric pressure, and at temperatures ranging from 30-70°F., but preferably at 35-45°F. Sulphuric acid serves as catalyst. It is found that, as the operating temperature is increased, a more dilute acid must be used to be equally active. The resulting, more corrosive situation is evident. At the same time, it is found that the quality of the alkylate is improved (due to the limitation of side reactions) by operation at lower temperature. A lower limit is set for the useful temperature, however, by the tendency of the hydrocarbon-sulphuric acid emulsion to stiffen to unmanageable consistency below 30°C.

Contact Time in Reactor

Contact time in the catalytic reactor ranges from 4 to 30 minutes, depending on the feedstock and on the efficiency of agitation. Acid consumption varies from 0.8 lb./gallon of alkylate produced (where the olefine is amylene) to 2.0 lb./gallon of product in alkylation with propylene. To a significant extent, acid consumption is tied to the degree of dilution permitted for the spent acid. While make-up acid is generally of 96-100 per cent strength, concentration of spent acid runs closer to 90 per cent, and values as low as 85 per cent have been employed successfully in some of the more efficient modern reaction chambers. Indications are that the consequent reduction in acid consumption is brought about without apparent deterioration in alkylate quality.

As in the case of thermal alkylation, high paraffin-olefine ratios are employed in order to minimise polymerisation reactions and consequent yield loss. In the reaction of *iso*butene with butene-(1), a ratio of 5: 1 is the commercially feasible minimum. Commonly, operation is at a paraffin: olefine ratio in the neighbourhood of 7: 1.

Maintenance of Emulsion

As far as mechanical operation of the reaction chamber is concerned, a primary difficulty rests in the maintenance of a thorough emulsion between the hydrocarbon stock and the sulphuric acid, which are characterised by wide divergence in specific gravity. Adequate provision must be made following the agitated chambers for proper separating control in order to minimise acid carry-over with the effluent hydrocarbon.

A useful recent innovation in reactor design has been developed by the M. W. Kellogg Company to overcome some of these difficulties. The unit consists of a horizontal chamber sub-divided into five separate compartments. Flow from the first to the last section is in cascade fashion. Agitation and feed points are provided in the first three compartments which serve for the reaction proper. Feed enters the first section with a paraffin-olefine ratio of, say, 9: 1. In the course of its passage through this area, the olefine is almost completely utilised, as is also one part of paraffin. The liquor entering the second compartment is then refortified with paraffin: olefine ratio of 1: 1. Internally, this raises the ratio again to nearly 9: 1. The process is again repeated in the third chamber. Thus, an internal paraffin-olefine ratio of 9: 1 is maintained with an external ratio in the feed amounting to only about 4: 1.

This design also permits more efficient acid utilisation and highly effective agitation in the reaction chambers, followed by settling and separation in the last two compartments.

Another important new feature in 'cold' acid' alkylation, which will materially reduce investment costs, is auto-refrigeration. Here, reaction temperature is maintained at the desired low level by permitting the evaporation of unconverted C_3 and C_4 hydrocarbons from the alkylation phase. These gases are recompressed and recondensed externally prior to their return to the system.

Better Yields Possible

In alkylation with propylene, better yields and reaction rates are found possible with the use of anhydrous hydrofluoric acid than with sulphuric acid. The process, which has found considerable commercial application, has the further advantage of obviating the need for refrigeration. Reaction temperatures are of the order of 80-90°F. and operating pressure is in the range of 100 p.s.i.g. As in the other two commercial alkylation processes, polymerisation must be repressed by the use of a high paraffin: olefine ratio. The amount of acid required in contact with the hydrocarbon phase is large—often exceeding the latter in volume. Actual HF consumption is quite low, however (approximately 0.5 lb. per barrel of alkylate) and recovery is simple, by vaporisation followed by recompression and condensation.

The German Chemical Apparatus Industry

Difficulties of Post War Reconstruction

THE difficulties which the German chemical apparatus construction industry has had to face in its post-war reconstruction are emphasised in an article by Dr. H. J. Stroer, of Düsseldorf, in *Wirtschaftsdienst* for April, 1952. Noting the widespread use in German industry of chemical apparatus and the very great technical diversity of the manufacturing processes it serves, he expresses surprise that so few scientific organisations are conducting research on such apparatus. Two scientific organisations in Germany, namely the Association of German Engineers (VDI) and the Dechema, are doing valuable work on the development of processes, but the only organisation doing research on apparatus is the Institute of Apparatus Construction at Karlsruhe, and even this confines itself to analysing distillation and rectification processes and processes connected with pulverisation, dehydration and heat exchange. A step in the right direction is a Technical Manufacturing Processes Research Society which was formed at Cologne in January of this year and is setting up a Research Institute and making arrangements for the close exchange of information with other research organisations.

Place Taken by U.S.A.

Scientific research in these departments is urgently needed, says Dr. Stroer, since Germany's former place as the leading producer of chemical products has been taken over by the U.S.A. Dr. Stroer complains strongly that all information on German manufacturing processes contained in the Fiat, Cios and Bios reports had to be handed over after the war and German patents confiscated. He says that 'even the victors admit that their value ran into milliards', and comments that far too little publicity is given to the fact that the German firms who owned the confiscated patents cannot make use of them if they are being used by firms in allied countries.

Dismantling, both material and intangible, as well as embargoes, controls on manufacture and the present unsettled conditions of ownership in the chemical industry have also had very serious effects on apparatus construction in Germany, says Dr. Stroer. No other branch of the German capital goods industry found it so difficult and took so long to recover from the war and its aftermath. An industry hemmed in as is the present German chemical industry, he says, is naturally backward in the matter of investments, since existing plant not fully used acts as an ominous warning against purchases of new plant.

Revival of Export Trade

However, the picture is not quite so gloomy as it appears. The index figure for the production of the German apparatus industry is still substantially below that of other branches of industry, but there was a considerable revival of export trade last year. In fact, the percentage of exports to total production of apparatus has now caught up with the pre-war level of 40-50 per cent, and this in spite of the fact that it has been very difficult for Germany to recapture old markets or enter new ones. Not only have they had to set up new representations abroad—with all the psychological, economic and financial obstacles that this entailed—but they have had to meet efficient foreign competition in foreign markets from countries now manufacturing apparatus for themselves.

Dr. Stroer remarks that one feature of the German apparatus export industry which has survived even the war is the reputation it won in plant sales—business which calls for a far higher degree of confidence in the efficiency and experience of the seller than sales of single items of machinery and individual apparatus, because of the considerable risk involved in distant delivery dates and the guarantees which have to be given. This market in plant has always been a successful feature of the German apparatus industry, and a high proportion of present German apparatus exports are of plant.

Dr. Stroer comments on the likely potentialities of undeveloped countries such as India, Africa and South America. These nations, he says, have by-passed the long years of chemical evolution traversed by older countries and are starting straight away on modern production processes such

as the manufacture of artificial fertilisers, cleansing agents, insecticides, and so forth. He thinks that despite the over-production of apparatus in many industrialised countries, the German apparatus industry will continue to find ample scope for its activities in world markets in the future.

Decline in German Exports

Chemicals Under Price Pressure

MORE difficult trading conditions are reported by most chemical manufacturers in Western Germany. Though there has been a seasonal improvement in the demand for paints, lacquers, etc., from the building industry, most other consumers of chemical products still suffer from excessive stocks accumulated in the course of last year. The German textile industry recently reported new orders being received at the rate of less than four-fifths of present production while at the corresponding period of last year order books were increasing.

Chemical exports in the first few months of this year were 16-20 per cent below the 1951 average, and though there has been an improvement in shipments abroad since Easter, few manufacturers now anticipate a substantial further expansion of foreign sales, which last year provided the West German chemical industry with 22 per cent of its total turnover. The decline in exports seems to be due largely to a decline in the demand for products until recently in short supply. Panic buying and hoarding of these have abated, and their prices have dropped noticeably. Last year when German chemical exports increased from DM.1,080,000,000 to DM.2,110,000,000 the volume increase was only 50 per cent; half the export gains were thus due to higher prices.

Economy Measures Necessary

Lower prices, both in the export market and in some sections of the domestic trade, have caused German chemical manufacturers to look for means of economy, in particular by cutting down on the consumption of high-priced import coal. Large purchases of foreign coal drove up the average cost per ton of coal used in the chemical industry from DM.47.85 in the first quarter to DM.70.30 in the fourth quarter of 1951. Reduced consumption of imported coal can thus yield substantial savings.

Factors likely to affect the German chemical export trade this year are import restrictions in the sterling and franc areas, saturation of the U.S. market for certain organic compounds, replenishment of stocks in Latin America and other overseas countries in which German exporters scored last year, and the repercussions of Germany's creditor status in the European Payments Union. The demand for dyestuffs and other products for use in the textile and leather trades has diminished substantially both at home and in the export market.

Symptomatic of the altered situation is the fact that for the first time since the currency reform the oil refineries in the first quarter of 1952 reported a decline in production compared with the preceding quarter. The decline, though slight, is the result of deliberate curtailment of refining operations necessitated by difficult market conditions. The total oil refinery output in the first three months ran at an average rate of a little over 400,000 tons.

Among new products put on the market by German manufacturers is polytrifluorochlorethylene, sold by Farbwerke Höchst under the name of 'Hostaflon,' a new insecticide based on the American 'Toxaphene', which is marketed by F. Schacht KG of Brunswick under the name of 'Toxol'; new lacquers made by Cassella of Frankfurt for the film industry, a hormone weed-killer for special use in forestry sold by Farbenfabriken Bayer AG under the name of 'Tributon'; and several new dyestuffs.

Monostearate Banned

THE United States Government has issued an edict barring the use of chemical softeners in the making of bread. The Food and Drug Administration, specifically singled out polyoxethylene monostearate as a chemical softener or emulsifier which may no longer be used in the baking of bread that enters into interstate commerce. The new standards are to go into effect and become law on and after August 12, 1952, and will be enforced by agents of the Food and Drug Administration.

While barring the use of polyoxyethylene monostearate, the FDA will continue to permit the use of monoglycerides and diglycerides in shortenings in limited quantities.

Multi-way PVC Tubing

Advantages in the Conveyance of Gas & Liquids

IN conveying gas, air, or clean liquids over a distance, previous methods of distribution have utilised separately installed, single tubes of copper or steel. As an alternative to metal tubing, however, single PVC (polyvinylchloride) tubes have found increasing application; combining, as they do, mechanical flexibility with resistance, to oil, moisture, and various acids and alkalis. PVC tubing of this kind has been supplied by Pirelli-General Cable Works Ltd., for many years.

Various Assemblies Available

Such tubing is now available in multi-way form for situations where the laying of an assembly in long lengths has technical and economic advantages over the separate installation of single tubes. Pigemultiflo tubes (Patent No. 627,031), are laid up in the form of a cable with the interstices filled with jute wormings. The standard size of tube adopted is ¼ in. bore with a wall thickness of 0.060 in., but ½ in. bore tubes with the same wall thickness are available. At present assemblies are available with seven ¼ in. tubes and fourteen ½ in. tubes, and the maximum manufacturing length is 500 yards. Colour distinction is made by the use of red, white and black tubes, and where necessary by a coloured longitudinal line on a base colour.

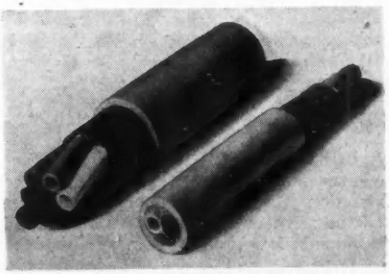
A PVC sheath is normally applied, and where the possibility of mechanical damage is present or the assembly is to be carried in cable hangers or cleats, single galvanised-wire armouring is desirable. This is applied directly to the PVC sheath, and where again protection of the galvanised-iron wire against corrosion is necessary, an external, compounded jute serving or hessian tape is applied overall. To distinguish these tubes from electric cables having a similar appearance, they can be supplied with a red PVC sheath.

Pigemultiflo tubes were originally developed for instrumentation purposes, using dry air at pressures up to 35 p.s.i. gauge, and they are accordingly tested individually at 50 p.s.i. gauge before being laid up. Developments now in progress to reinforce the single tubes will render them suitable for pressures up to 200 p.s.i. gauge. Joint boxes and terminations are similar to corresponding boxes used for electric cables, complete with cone clamps for armoured assemblies. As the purpose of the boxes is mechanical protection only, no form of interior sealing is necessary.

The first commercial installation was put into service in 1946 in connection with an extensive, instrumentation system at a chemical works on the north-east coast. In order to indicate water levels at sea-water process pump intakes, especially at night and at times when the actual sea conditions could not be estimated visually, armoured Pigemultiflo tubes were taken 300 yards out to sea along two jetties. They connected the central control-room instrumentation (which included sea-water level indication, water flow and tide gauging), to the submerged, depth-level apparatus at the sea ends of the jetties. Compressed air in the tubes bore on the sea-water surface, and the resulting variation of pressure gave the level indication at the control room panel.

These assemblies have been subjected to the full force of tides and gales and are submerged for 12 hours out of 24, yet the whole installation has remained in service without failure or leakage, and so far reveals no deterioration. All types of installation have been carried out on this site, including assemblies laid in the ground, cleated to walls, and suspended from a catenary wire.

Installation methods are identical with those for electrical cables, but Pigemultiflo



Two common assemblies of PVC tubing

tubes have the advantage of a much reduced weight in proportion to diameter. A further major advantage claimed is that, with the long lengths available, the frequent joints necessary in steel or copper pipe are entirely eliminated, thereby obviating these potential sources of leakage. It is also said that the worse the erecting conditions, the cheaper is the overall cost of installation of Pigemultiflo tubes as compared with that of metal tubing.

A salient feature of Pigemultiflo tubes is said to be the virtual elimination of the risk of flattening by accidental mechanical damage, which is always present with metal tubing. This risk may be particularly serious at such points as the entry to a control room, where a number of tubes are adjacent and may be damaged simultaneously. Tests have shown that Pigemultiflo tubes have a high resistance to flattening and are more robust than single, metal tubes, as even if temporarily trapped they will recover on release. The methods of installation, moreover, tend to prevent an occurrence of this nature.

Reduced resistance to damage by fire due to the thermoplastic nature of Pigetube, must, however, be considered. Although the material of the tubing is highly resistant to burning, it can be made to take fire under a direct flame, but combustion does not continue after this source of heat is removed. Owing to the thermal mass of the assembly and the thermal conductivity of the armour, there is such a resistance to local heating that the line is unaffected by exposure to a live steam jet, such as might result from a leak in a steam main on the same supports.

From its nature, this type of multi-way assembly will probably find its widest field of application in the petroleum and chemical industries, where the maintenance of the racks required to support metal tubes is often a problem.

Ex-Enemy Experience Compiled

A BIBLIOGRAPHICAL survey of German and Japanese experience in the extraction of low-grade non-ferrous ores and the recovery of non-ferrous metals and compounds, has recently been published by the Department of Scientific and Industrial Research (Technical Information and Documents Unit). This report (No. RMS-3, obtainable from HMSO, price 3s. 6d.) represents the results of a comprehensive review of all the documents and reports held by the TIDU, covering possible economies through the recovery of waste material from various sources and the extraction of low-grade ores which would, under more plentiful conditions, prove uneconomic.

It is well-known that the Germans made considerable efforts along both these lines, tending more towards the utilisation of scrap, partly due to the shortage of virgin metals, but also to the fact that methods have been improved to such an extent that recovered alloys give service comparable with alloys made from virgin metals. Such was their success in recovering vanadium from steel slags during the war that the shortage of this metal was completely eliminated and it was actually substituted for other scarcer metals such as tungsten and molybdenum.

The present survey contains 7 sections, and deals with Cu,Pb,Zn,Sn,Sb,Ni,Co, and Cd; Al, Mg, and Be; Cr,Mo,W, Tungsten Carbide and Hard Metal, Mn,V,Nb,Ta, and Ti; Pt,Re,Ir,Pd,Au,Ag,Hg,Th,Ce and the Rare Earths, and Zr; and Se. In all cases it includes production and recovery of the metals. The first section covers mining, ore dressing and statistics. Documents listed include BIOS, CIOS, and FIAT reports, German documents, and U.S. Government reports.

New Standard Oil Plant

THE Standard Oil Company (Indiana) has engaged the M. W. Kellogg Company, refinery and chemical plant engineer-contractors, to construct a large *iso*octyl alcohol plant at its Wood River (Illinois) refinery, it was announced by Kellogg recently. The plant is divided into three main parts; a fractionation system for obtaining heptane as a 'heart cut' from an olefine feed stock; a refinery gas reformer for preparation of hydrogen and carbon monoxide; and finally, the actual *iso*octyl alcohol section where the heptane, hydrogen and carbon monoxide are reacted. Process design for the last-named unit will be Standard Oil's. The other two sections will be Kellogg designs. A primary use of *iso*octyl alcohol, to be produced by the new plant at an annual rate of about 4,500 tons, is in the manufacture of plasticisers.

India's Chemical Industry

Accelerated Progress Due to Two World Wars

THE rise and development of the chemical and ancillary industries in India has been summarised in 'A Survey of the Indian Chemical and Pharmaceutical Industry, 1951', published by the Indian Chemical Manufacturers' Association.

Due to many adverse factors, both economic and political, progress of the chemical industry in India was at first slow, and its acceleration in more recent years has been largely due to conditions arising from two world wars.

In the period between the wars the most important step taken was the enactment of the Heavy Chemicals Industry Protection Act in 1931. At that time, apart from galenicals, only sulphuric acid and its derivatives were manufactured in India. The new Act, however, gave a considerable impetus to the manufacture of drugs and chemicals, as it was realised for the first time that the Government was willing to grant protection to a young and growing industry if an adequate case could be made out for it.

Central Control of Industries

Employment of India as an important supply base for the Allies in the last war led to a central control over important industries and an encouragement of private trade which, at the end of hostilities, the Government felt should be consolidated. It was recognised that the industrialisation of the country should be the outcome of deliberate and balanced planning and should not be left entirely to the necessarily un-coordinated efforts of individual industrialists. A number of panels were created, development committees established and a Ministry for Scientific Research and Natural Resources was constituted.

Following the Planning Commission Report, 1951, which gave the development of industries second place to the need for self-sufficiency in food, the Government is now committed to a policy of mixed economy, and the development of industry is left to a large extent to private enterprise.

In an introduction to the survey, by L. A. Bhatt, president of the Indian Chemical Manufacturers' Association, it is pointed out that the requirements of many raw and intermediate chemicals are not large enough to enable private industry to undertake economic production, as it would be some time before there could be results sufficient to warrant investment of the shareholders' money. If the State does not eventually intervene this may well prove a weakness in the whole structure of the industry.

Obstacles to Progress

Some of the main obstacles to progress have been the control of imports of essential chemical plant and equipment, delayed delivery of plant and the increased cost of capital goods which has acted as a brake on the rehabilitation of worn-out machinery. A further difficulty has been the over generous grant of quotas for import of items such as soda ash and caustic soda which seriously affected indigenous production.

The survey is divided into nine sections covering acids; fertilisers; alkalis, fine chemicals; pharmaceuticals; coal tar distillation; plastics; dyestuffs; and miscellaneous productions, which include bichromates, magnesium chloride, chlorates, saltpetre, industrial gases, photographic chemicals and textile auxiliaries.

Among the conclusions reached by the association in the summary at the end of the section on the acid and ancillary industries the following action is recommended:—The scrapping of a considerable number of small sulphuric acid manufacturing units for larger and more economical plant, with careful consideration as to their location; installation of plant for the recovery of sulphur from coal, particularly in Assam, where the sulphur content is known to be high; construction of plant for the recovery of elemental sulphur from gypsum and pyrites in preference to incurring heavy expense by putting up modified burners at existing plants; and investigation to see where and in what processes the use of sulphuric acid could be eliminated, or whether alternative materials could be used.

Dyes to Meet Home Needs

Certain groups of dyes are now being manufactured on a sufficiently large scale to meet the entire needs of the country and in

its conclusions of this section the association suggests a total ban on imports of stabilised azoics (Rapid Fast and Rapidogen types of dyes); developing salts, and Green IB and Blue O4B of the Solubilised Vat Group.

One of India's key industries is undoubtedly that of industrial gases. A major problem in this connection has been the supply of cylinders, all of which have to be imported. Schemes are, however, in hand to overcome this difficulty and meet increasing demands by the delivery of bulk liquid oxygen to consumers' works.

A section of the survey devoted to an interesting analysis of chemical engineering progress in India reveals that, unlike a number of Western nations, the supply of chemical engineers is in excess of the demand, and their placement has become a serious problem. It is clear, the report states, that the time has come for a consolidation of the existing facilties for chemical engineering education rather than their expansion.

Chemical Engineering Progress

Much of the chemical engineering research in India is at present concerned with utilisation of locally available raw materials or with studies and modifications of processes and operational techniques that are well-known abroad but are either unknown or find comparatively few applications in India. There is evidence that the manufacture of chemical plant within the country, however small or simple, is on the increase.

The survey is concluded by a chapter which gives an overall picture of the previous sections and analyses future prospects of the chemical industry in India.

There is also a statistical section; a classified index to chemicals and chemical products made in India with their manufacturers; and a list of members of the Indian Chemical Manufacturers' Association.

Acknowledgment is made to Technical Press Publications, Bombay, publishers of *Chemical Age* of India, and particularly to Mr. J. P. de Sousa, M.Sc., its editor-publisher, who was commissioned to edit and publish the survey on behalf of the Indian Chemical Manufacturers' Association. The survey appears as Review Number Series 4, price 15s. Technical Press Publications is represented in the U.K. by A. Vernon Keith & Co., Napier House, 24-27 High Holborn, London, W.C.1.

Coal Tar Products

Census of Production Report for 1948

A COMPREHENSIVE survey of the Coal Tar Products trade is given in the Final Report on the Census of Production for 1948, Volume 2, Trade D, published by the Board of Trade (HMSO, 2s. 6d.).

The coal tar products trade is included among the miscellaneous chemical industries in minimum list heading 31 (4) in the Standard Industrial Classification and the report relates to establishments engaged wholly or mainly in the manufacture by tar distillation of coal tar products other than dyes and dyestuffs. (A summary of the preliminary report, No. 27, appeared in THE CHEMICAL AGE, **62**, 913).

Figures for production, number of persons employed, stocks, and so on, for 1948 are shown in comparison with the years 1946, 1937 and 1935.

Any establishments in Northern Ireland are, however, excluded in 1948 and no production in this trade was recorded there for 1937 and 1935.

In 1948 the total number of establishments was 94, which included 16 firms employing on an average 10 persons or less. Of the 78 larger firms, 64 were situated in England, five in Wales, and nine in Scotland.

Steady development of the trade is reflected in the gross output (production) which was valued (in £'000) at 18,993 in 1948 compared with 14,316 (1946); 6,929 (1937) and 5,226 (1935). The average number of persons employed in 1948 by the larger establishments (i.e., employing on an average more than 10 persons) was 6,122, which was nearly 1,000 more than in 1946, and nearly 2,000 more than 1937 and 1935.

Stocks of finished products and work in progress in the larger establishments at the end of 1948 were valued at £1,473,000.

£15,000 Spent on Research

Repair and maintenance in 1948 by the larger establishments afounted to £332,000. Payments for research work totalled £15,000, of which £11,000 went to research associations, £2,000 to universities, institutions, academic bodies and similar agencies, and the remainder to other commercial concerns.

Acquisitions of plant and machinery in 1948 were valued at £527,000 (new) and £8,000 (second-hand) while £27,000 worth was disposed of.

Chemical Engineers' Symposium

Plant Fabrication & Erection Discussed

AT a symposium on chemical plant construction given by the Graduates' and Students' Section of the Institution of Chemical Engineers on 16 May at the Alliance Hall, London, four papers were read on the fabrication and erection of chemical plant. The symposium formed part of the annual general meeting, and was followed on the evening of 17 May by the annual dinner and dance. The symposium, which was originally to have been held at Caxton Hall, had to be moved to Alliance Hall owing to the large number attending.

Owing to lack of space we are unfortunately unable to give the first two papers on plant fabrication, read before lunch, by G. A. Dummett, M.A., A.M.I.Chem.E. (Scientific Manager, A.P.V. Ltd.), and a deputy for H. B. Fergusson, M.I.N.A., M.I.Mech.E. (Director, B.C.P.M.A.), who was unable to be present. Mr. Dummett's paper was entitled 'Fabrication of Non-ferrous Plant and Unit Plants for Special Products,' and Mr. Fergusson's was called 'Fabrication in Ferrous Materials with special reference to Pressure Vessels.'

In the second session, held after lunch, on plant erection, two papers were read. The first, on 'Construction Planning and Plant Erection' was by Mr. R. J. Cole, the Project Manager of Foster Wheeler Ltd., at Fawley. Owing to an unexpected call to Antwerp, however, Mr. Cole was unable to give his paper personally, and it was ably read instead by Mr. Lightfoot, also on the planning side at Fawley. Mr. F. E. Warner, Chief Chemical Engineer of Carless, Capel and Leonard, Ltd., was in the chair.

Work Needed at Fawley

Mr. Lightfoot started by giving a rough outline of the work needed before a £40,000,000 project like Fawley reaches the erection stage. Initially engineering plans for construction and the procurement of materials must be integrated and the various phases of erection carefully planned and co-ordinated. The shortest possible time to build is estimated, and the manpower distribution is graphed. Joint consultation with the trade unions involved is set up to discuss conditions of work, and a survey party is sent to the proposed site by the contractor's field organisation.

The task of this survey party is a big one. The make-up of the terrain must first be determined by boring parties, and the soil bearing pressures and the nature of the substrata must also be investigated. These factors decide whether there will be any need for piling. At the same time, local labour is explored and the amount available, if any, gives the contractor an idea of how much labour will have to be imported into the area.

New Buildings Needed

If additional labour has to be imported, housing, canteen and recreational facilities must be available, and sources of building materials must be found to build these. The area must be surveyed for sources of cement and aggregates, as well as for local supplies and transport, and these implemented where necessary. Transport is also discussed with road, rail and shipping companies in the area. Local burning restrictions, in the area, if any, are investigated, and Government agents are contacted to establish liaison between the field organisation and the Home Office. In addition, the availability of clerical staff is ascertained.

At Fawley it was found that 750 workers had to be housed in a camp, and a concrete and aggregate plant had to be erected as the whole 750 acres was a gravel deposit. Transport used to carry the labour force to the refinery site when the plant was being erected, was 100 buses and 4 trains a day.

When the field survey has been carried out and analysed, the top supervisors are selected and the starting date set. At Fawley no sub-contractors were employed as far too many supervisors would have been needed to watch the sub-contractors. Besides this, building is far quicker and there are far fewer overheads and consequently greater saving if the erection is carried out by the contractor direct under central control, as backward phases can be co-ordinated with phases that are forward. The success of this method was amply demonstrated at

Fawley when the plant went on stream six months ahead of schedule.

Labour negotiations at Fawley occupied from three to four months before agreements were signed. The success of these negotiations and the contractors' handling of labour were so good that of the 6,500,000 man-hours needed to build the plant, only 1,000 were lost through industrial disputes. A machine method of accounting was introduced which eliminated a large number of clerical staff, after the relative costs of machine and manual accounting had been demonstrated to the owners.

In order to meet the shortage of experienced welders, a welding school was set up at Fawley early in the proceedings, together with an instrument training school.

Decision to Rephase

For a year and three months the phasing of the various operations was closely watched. At that time it became clear that parts were available for some parts of the project which were not scheduled for erection until after the completion of the first half of the refinery. This being so, the very difficult decision was taken to go ahead with putting this part of the project into operation rather than wait for completion, as it would mean a great saving in time and the refinery would be able to go on stream sooner. This meant that all schedules had to be revised, and manpower had to be rearranged to fit in with the new schedules. Altogether, half the total refinery had to be rephased and put into proper sequence of erection.

The needs of the customer during this period of erection are met by a field organisation belonging to the customer. This organisation inspects field expenditure, and must have enough staff and enough authority to give a quick decision on all items of difficulty as they occur. Paying tribute to the Resident Engineer at Fawley, Mr. Lightfoot said that there was never any delay over the taking of decisions, and because of the Resident Engineer's enthusiasm, red tape was cut to a minimum.

Discussion

In the discussion which followed Mr. Lightfoot's paper, several questions were put to him. The first questioner posed the delicate question of the equivalent productivity of U.S. and U.K. labour. Mr. Lightfoot replied that when starting to plan the project, his company equated one U.S. man-hour with two U.K. man-hours. After starting, this factor was lowered to 1.56, and now that the British workmen were more familiar with the equipment and the work involved, he would say that there was no difference between the two.

One questioner asked the rôle of the safety officer on site. This officer works with the insurance companies to make certain that all authorised tests have been performed and are shown as having been carried out in case of accidents. He is also responsible for seeing that such things as scaffolding are properly erected and conform to regulations.

In answer to a questioner who asked at what level did Foster Wheeler Ltd. begin recruiting U.S. and U.K. staff, Mr. Lightfoot replied that he thought the questioner probably meant why did the company recruit American staff at all. The answer to this, he said, was that the Americans had had more experience in the erection of oil refineries, and that in matters like the cost estimation of a labour force, it was essential to have comparable figures of previous work to rely on. The figure that the company used for estimating was 192 man-hours to 1 man-month, but it was almost impossible to calculate labour costs without previous experience. Asked what percentage of the material at Fawley was bought in the U.S., Mr. Lightfoot replied that all the process equipment was American.

More Power to the Erector

The next question raised was why more power was not given to the erector on site, and time and expense thereby saved on complicated engineering drawings showing the exact position and connections of every pipe. Mr. Lightfoot agreed that much work could be saved by this method, but Mr. K. B. Ross, recently Anglo-Iranian general manager in Persia, suggested that from his experience of having this pipe connected to that one on site, as the constructor thought it ought to go, the idea was not a very happy one.

Mr. Warner as chairman, summed up, and to illustrate the difficulties that can beset the chemical engineer in the field, he told the story of one chemical engineer who had been engaged to build a plant by the

Russians with the aid of 150 German fitters and 15,000 political prisoners.

The last paper was read by H. E. Charlton, M.I.Chem.E., the engineer-in-chief of Petrocarbon Limited, with Mr. K. B. Ross in the chair. The subject of Mr. Charlton's paper was 'Erection Problems encountered in a Petroleum Chemicals Plant' and it dealt with the building of the petroleum chemicals plant at Manchester in 1946 for the processing of petroleum naphtha. The capacity of this plant is 75,000 tons of naphtha per annum, and its building was described in a pamphlet issued by the company recently (*see* CHEMICAL AGE, **65**, 838).

Mr. Charlton said that difficulties and problems in the building of a petrochemicals plant arise from various causes which can be grouped under five headings: policy problems; technical problems; material problems; human problems; and administrative problems.

The first problem in building the plant is to determine its proper size, measured in product output. As the Partington plant was based on a completely new process, the operation of this plant was partly speculative at its inception. It was essential, therefore, not to make it too large, yet it had to be of an economical size and capable of being added to in the future without increasing the fixed charge significantly.

Advantage of Mobility

By employing direct labour a greater degree of mobility of workmen was possible and in view of the irregular deliveries of materials this was a very great advantage and enabled gangs to move from plant to plant as designs, materials, weather conditions and other considerations warranted. Such an arrangement would only have been possible with a contractor working on a cost plus basis, a system which was avoided as much as possible. Another very important consideration was the right number of construction people to put on to a plant. If too few, the supervision was apt to be bad and the costs went up; if too many the congestion reduced efficiency and the law of diminishing return came into force and there was, therefore, a minimum time below which it was impossible to build a plant, however many men were loaded on to the job.

Following on this point of labour loading when the Control of Engagement Order was in force, and in order to keep a good standard of workmanship it was necessary to give a considerable degree of security of employment to the workmen engaged. Having regard to the difficulties under which the labour force at Manchester was built up, the standard of workmanship was extremely high; for example, a team of welders was recruited capable of welding any metals and alloys and accepted by the Insurance Company for the welding of Class 2 pressure vessels. The rhythm of constructional work was buffered by a certain amount of plant manufacture, and although the costs were slightly higher than those of contractors, the standard of workmanship was very much better, and, of course, it must be taken into consideration that most of the plant manufactured in this way by the company was not easy to obtain quickly from any other source. In this way the company was able to keep control of the programme of the work by assigning appropriate priorities to this manufacture.

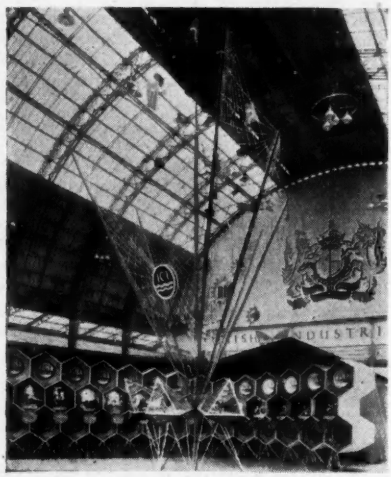
Storage and Protection of Materials

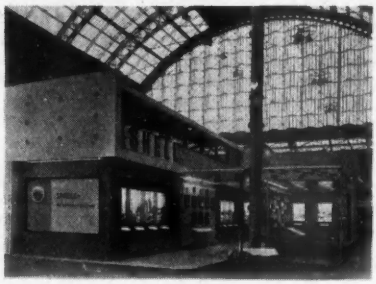
There was a period during construction when a vast amount of valuable material and plant was being received on site and its storage and protection was often a major problem. Permanent storage buildings could, of course, only be justified to an extent which was needed finally for stores when the plant was completely erected, and many temporary compounds had to be created and means provided for protecting some of the material and plant against the weather. The presence of such quantities of valuable material tended to make personnel careless in handling and accounting as the high cost and difficulty of replacement was apt to be overlooked. Protecting machinery against the effects of dirt was also a problem, and in periods of high wind on this particular site sand was very troublesome. It was difficult to impress on workmen the need for economy in the use of consumable stores, welding rods and the like, when so much of everything was in evidence.

Labour Relations Important

Labour relations and trade disputes represented one of the most important of the human problems, and although not in the field of chemical engineering, was a problem which often confronted chemical engineers and challenged their tact, understanding and tolerance.

More Scenes at the B.I.F.





Shown above is the stand of Shell Chemicals Ltd. at Olympia

Above: Main I.C.I. stand at Olympia. Right: The Mayor of Westminster Councillor A. Sciver, B.Sc., F.R.I.C. watching a demonstration of the Nivoc Automatic Aperiodic Balance on the stand of W. & J. George & Becker, Ltd.

Left: Bakelite's stand at Birmingham, showing the basic material displays in the background and showcases of finished products in front

The Chemist's Bookshelf

DIFFUSION IN SOLIDS, LIQUIDS, GASES. By W. Jost. Academic Press Inc., New York. 1952. Pp. xi + 558. $12.00.

Every fundamental physicochemical process, however academic its original interest, eventually reaches a stage of development at which its potential usefulness in cognate and applied fields becomes far-reaching. There is always the need at such a time not only for an authoritative and critical survey of the *status quo*, but also for an informed appraisal of future trends and possibilities. In short, there is always the need for a monograph by an authority who can simultaneously meet the needs of the specialist and convey perspective to the more general reader. The task is a difficult one, but Professor Jost has accomplished it for diffusion processes in the work under review. It is one of a series of monographs on important physicochemical topics. Professor E. Hutchinson, of Stanford University, California, is general editor of the series.

Professor Jost originally intended to write a second edition of his 'Diffusion und Chemische Reaktion in Festen Stoffen' (Leipzig-Dresden, 1937). The intervening years have, however, brought such widespread advances in our knowledge of diffusion processes in general that such a policy would have proved rather restrictive. Treatment of diffusion on a broad comprehensive basis was needed, and this demanded the entirely new plan of the present book.

The author's procedure is readily apparent from the nature and order of the chapter headings which are as follows: (1) The Fundamental Laws of Diffusion, (2) Disorder in Crystals, (3) Theory of Diffusion in Solids, (4) Electrolytic Conduction and Diffusion in Ionic Crystals, (6) Solubility in Solids, (7) Permeation and Diffusion of Gases in Solids, (8) Mobility of Ions in Solid and Molten Metals and Alloys, (9) Surface Reactions of Metals, Formation of Protective Layers and Related Reactions, (10) Diffusion in Gases, (11) Diffusion in Liquids, (12) Thermal Diffusion.

The theoretical chapters are lucid and their practical implications are always stressed, for Professor Jost is an experimental physical chemist writing mainly for his colleagues. The entire treatment is illuminated by carefully chosen examples, presented in great detail. These provide a reliable guide to the planning and understanding of diffusion experiments under a wide variety of conditions.

For each topic, the most important results obtained up to the present time are surveyed, and complete reference lists of the original literature supplied.

A noteworthy feature of the book is that it makes available in English the more important continental contributions of the last decade. This is specially apparent in Chapter 4, for most of the work on diffusion in ionic crystals has been carried out in Germany.

The book is well produced and the reviewer discovered no misprints. One slight criticism concerns the index of authors. It seems a pity that this is restricted to those referred to directly in the text and excludes names which only appear in reference lists of the original literature.—H. MACKLE.

HYPERCONJUGATION. By J. W. Baker. Oxford University Press, London. 1952. Pp. vi + 158. 18s.

Conjugation, which is the special form of interaction of two double bonds separated by one single bond as in butadiene, $CH_2=CH—CH=CH_2$, has been recognised for many years both in simple systems and in the important case of aromatic ring systems. The theoretical aspects have been treated both by the valence bond method which shows the existence of resonance stabilisation, and by the molecular orbital method which shows how delocalisation of the electrons leads to added stability and which also shows how substituents at one atom of the conjugated system are able to influence reactions occurring at remote atoms.

The possibility of similar conjugation effects arising from the interaction between

a *single* bond and a double bond has been considered in recent years and the name 'hyperconjugation' given to this special form of conjugation. J. W. Baker's book deals with this topic of which the most important cases involve the collective conjugation of the three C—H bonds of methyl groups with a double bond or conjugated system as in propylene, $CH_3—CH=CH_2$, or toluene. In valence bond language this means that contribution of forms such as $H^+ \; CH_2=CH—CH_2^-$ to the resonance hybrid are not neglected.

After a brief historical introduction Baker explains how both the valence bond and the molecular orbital treatment indicate that hyperconjugation is possible but that it should be much weaker than simple conjugation. In the second chapter he discusses the physical evidence from bond distances, dipole moments, spectra, heats of hydrogenation, etc. In the remaining six chapters the evidence from organic chemistry is fully presented, the more important topics being aromatic substitution, tautomeric equilibria, addition reactions, hydrogen halide eliminations, and attack by free radicals and atoms. In view of the comparatively weak nature of the interaction which leads to a stabilisation energy of under 3 k.cals./gm. mole per methyl group, it is not surprising to find that the evidence for hyperconjugation is not always decisive and may admit other explanations in terms of steric hindrance, polar effects and the like: these possibilities are referred to by the author in the relevant places.

This monograph will be useful to those who wish to have all the evidence and over two hundred references under one cover and it is valuable as an account of a branch of organic reaction mechanisms which has grown in recent years under the influence of C. K. Ingold, E. D. Hughes and J. W. Baker himself. Readers with more general interests may prefer to content themselves with short accounts of the essential features of hyperconjugation (as in section 12.4 of 'Valence' by C. A. Coulson, O.U.P., 1952) until the complete evidence can be critically selected so that the main outlines rise clearly from the experimental details. The printing and production are of the usual high standard of the Oxford University Press.—D.H.W.

TEXTBOOK OF ORGANIC CHEMISTRY. Third Edition. By G. H. Richter. New York, John Wiley & Sons, Inc; London, Chapman & Hall, Ltd. 1952. Pp. viii + 762. 54s. net.

The publication of a third edition of this 'beginning textbook' within 14 years is testimony of its popularity in America, the country of origin. The book contains a vast amount of information about aliphatic and aromatic compounds, and a useful but brief account of heterocyclic compounds. An excellent feature is the attention given to recent applications of the subject and to natural products; thus we find the oxo process and Reppe's vinylation work discussed. There are chapters on carbohydrates, amino-acids, alkaloids, and terpenes, and structures are outlined for many important natural products (e.g., penicillins, chloromycetin, and cortisone). Many reactions not usually found in elementary books are included (e.g., the Leuckart, Mannich, Ziegler bromination, and acyloin condensation reactions). Although many modern theoretical ideas have been discussed these ideas could have been applied more systematically throughout the text. For example, free radicals are only mentioned in passing, and archaic 'lassos' are liberally used in formulating reactions when a modern treatment might have been profitable.

There is very little about the historical side of the subject, and no references or suggestions for further reading are given; however, there are useful and searching questions at the end of each chapter. Errors in this well-produced book are infrequent; 'criflavine' appears on p. 711, there are mistakes in the table of electronic configurations (p.2), and the morphine formula (p. 739) could be improved. The names of several of the synthetic drugs will be unfamiliar in this country. In such cases, both U.S.P. and B.P. names might be given.

The book would be useful in the first half of four year honours chemistry courses in this country, and also would be particularly valuable to students taking subsidiary chemistry, general science, or pharmacy. The price will put it beyond the reach of many. In general, it is doubtful whether much expenditure of dollars on ordinary textbooks is justifiable at the present time. However excellent such books may be, few are unique. —W. WILSON.

HOME

Foundation Lecture

Dr. R. P. Dinsmore, vice-president of the Goodyear Tire and Rubber Co., Akron U.S.A., delivered the Seventh Foundation Lecture of the Institution of the Rubber Industry in the Wulfrun Hall, Wolverhampton, on Friday afternoon. His subject was 'The Economic and Physical Aspects of GR-S Modifications.' Sir Clive Baillieu, president of the Institution, presided.

Value of Trade Press

When Mr. D. J. Liston, M.B.E., the head of the information and statistical division of the Metal Box Company Limited, recently addressed members of the Royal Counties Branch of the Incorporated Sales Managers' Association at Windsor, on 'Budgetary Control in the Small Business,' he emphasised the value to commercial intelligence of the systematic reading and analysis of the trade press. It could be carried out, he said, by a member of the staff, trained and designated for that purpose and instructed to distil and extract such information. This type of material could throw positive light on trends and prospects, he said.

U.S.A. Plants Studied

Mr. M. K. Schwitzer, author of the book 'Continuous Processing of Fats', published last year, has just returned from a 20,000 miles trip to South America, Mexico and the U.S.A. He visited a number of firms interested in British chemical plant and has in particular made a thorough study of the vegetable oil industry in Mexico. In the U.S.A. he visited several of the most up-to-date oils and fats processors and had an opportunity of comparing methods.

Sulphur Recovery

Replying to a question on the progress of sulphur recovery from coke ovens, particularly those owned by the steel industry and the National Coal Board, Mr. H. Strauss, Parliamentary Secretary to the Board of Trade stated in a written answer in the House of Commons on 13 May that plants were now under construction for the recovery of some 10,000 tons of sulphur annually in the form of sulphuric acid. Other projects were under consideration.

Fluoridation of Water-supplies

In the House of Commons recently Mr. S. P. Viant asked the Minister of Housing and Local Government whether, in fluoridation of water supplies, the fluorine is added in the form of salts, or in what other form it was added. Mr. Harold Macmillan replied that in this country fluoride was not yet added to water supplies. In the United States of America, however, there was a growing practice to make such an addition and the fluoride was usually added as sodium fluoride, sodium silico-fluoride (fluosilicate), or hydrofluosilicic acid. The first two of these compounds were solid salts, but were usually made into an aqueous solution before adding to the water. Hydrofluosilicic acid was purchased as an aqueous solution.

Steel Output Lower

Production of steel in April was at an annual rate of 15,866,000 tons according to figures issued by the British Iron and Steel Federation. This compared with 16,648,000 tons in the previous month and 16,771,000 tons in April, 1951. The fall in output was almost entirely attributable to the shorter working month caused by the Easter holiday. Pig iron production at an annual rate of 10,472,000 tons in April was only 200,000 tons less than the previous month and was well above the production in April last year.

Report on Metal Finishing in U.S.A.

American practice in metal finishing will be discussed at the Glasgow meeting of the Institute of Metal Finishing on Thursday, 19 June, when members of the specialist team on metal finishing which visited the U.S.A. under the auspices of the Anglo-American Council on Productivity will report on impressions gained on their tour. The meeting will be held at 35 Elmbank Crescent and begin at 6.30 p.m.

U.K. Lead Cheaper

A reduction in the price of good soft imported pig lead by £16 from £147 to £131 a ton was announced by the Ministry of Materials on 14 May. The new price is the lowest quotation since October, 1950, and followed a drop of 2 cents per lb. for lead, spot, New York reported on 12 May.

OVERSEAS

Ireland Makes Zinc Oxide

To cut down on dollar imports, the Silvermines Lead and Zinc Co., Ltd., of the Irish Republic, are considering the production of high-quality zinc oxide. At present calamine ore deposits are treated in a Waelz Kiln and the burnt ores are chiefly exported to Great Britain for further processing. Plans are to install a Wetherill furnace which will enable the company to produce a high-grade oxide to compete with the imported product. In 1951 the Republic of Ireland imported 17,275 cwt. of zinc white or zinc oxide valued at £176,125.

DDT Factory for Delhi

A joint plan for the setting up of a DDT factory in Delhi will be shortly finalised by the Government of India, UNICEF and WHO. Under the plan, UNICEF will supply plant and equipment for the factory and WHO the technical aid in the form of training facilities and experts. The factory will produce 750 tons of DDT per annum and is expected to go into production in about a year's time.

International Galvanising Conference

The provisional programme for the second International Conference on Hot Dip Galvanising to be held at Düsseldorf from 30 June to 4 July under the auspices of the Zinc Development Association, has now been published. Some 150 galvanising experts from all parts of Europe as well as some from the U.S.A. are expected to attend the conference which will be held in the Landtage building. The wide range of papers to be read and discussed will include such questions as coating, structures, electrochemical behaviour, bath heating, etc.

Chemists Trained Abroad

Venezuelan technicians, principally chemists and chemical engineers, are being trained at the Celanese Corporation of America's plants in U.S.A. in preparation for supervisory posts when the Celanese Venezolana S.A. acetate yarn plant at Valencia comes into operation. The new plant is expected to give great stimulus to the local textile industry, which continues to expand.

Mexico Builds Coking Plant

A coking plant is scheduled to be built by the Mexican Nacional Financiera (the development and investment corporation of the Mexican Government) in the near future, at a cost of 80,000,000 pesos, in the State of Coahuila, according to reports. The plant will be built by a German firm of contractors, who will loan engineers and foremen to start production and supervise operations. Production, is is estimated, will be about 45,000 tons of coke per month. Ammonia, benzole and sulphuric acid will be produced as by-products.

Competitor for Krilium

In competition with Monsanto for the soil stabiliser field is American Cyanamid, who has just announced that it has already made available to agricultural research stations a hydrolysed polyacrylonitrile called X-19. The irony of this situation is that American Cyanamid has known for some time of the soil-stabilising properties of these compounds, and in fact mentioned them in a book on acrylonitriles published last year, before the Krilium announcement was made by Monsanto, but they failed to see their immense agricultural potentialities and thought of them mainly as additives for oil-well drilling muds. The patent situation on the compounds is still far from clear.

Rain Produced by 'Cloud-Seeding'

A claim to have established the successful production of rain by 'seeding' of clouds with silver iodide was made recently in a Tucson newspaper by Dr. Irving Langmuir, an associate director of the General Electric research laboratory. Dr. Langmuir, who was awarded the Nobel Prize in 1932 for his work in surface chemistry, had been conducting artificial rain tests sponsored by the United States armed forces. He stated that the efficacy of cloud-seeding was established beyond 'valid doubt'.

To Increase Production

The National Economic Council of Argentina has announced that steps will be taken to increase, as far as possible, production of wolfram, beryllium, mica, lead, sulphur, zinc, gold, manganese, graphite and salt.

· PERSONAL ·

DR. PAUL D. MERICA, executive vice-president, was elected president of The International Nickel Company of Canada, Limited, at the annual organisation meeting of the board of directors on 5 May, DR. JOHN F. THOMPSON, chairman of the Board and retiring president, announced.

R. LESLIE BEATTIE, vice-president and general manager of the company's Canadian operations, who is moving his headquarters from Copper Cliff, Ont., to Toronto, has been elected a member of the Executive Committee of the Board. H. C. F. MOCKRIDGE, Q.C., of Toronto, was also elected to the Executive Committee.

The Institute of Metal Finishing (incorporating the Electrodepositors' Technical Society) announces that the following officers have been elected by council for its 28th session 1952/53: *President*: H. SILMAN; *vice-presidents*: DR. S. G. CLARKE, DR. J. W. CUTHBERTSON, R. C. DAVIES, DR. G. E. GARDHAM, F. MASON, E. A. OLLARD, C. WHARRAD, and W. E. WRIGHT. F. L. JAMES has been nominated honorary treasurer and DR. S. WERNICK honorary secretary. The number of nominations for ordinary members of the council exceeded the number of vacancies and a ballot therefore became necessary. Ballot papers have been forwarded to members and should be returned not later than 15 June.

At the fifth annual general meeting of the Fertiliser Society held in London on 8 May, DR. E. M. CROWTHER was re-elected president and J. ANGUS, vice-president. Four new members elected to the council were: J. B. DAVIES, DR. J. MANNING, J. W. STEVENTON, and DR. R. STEWART.

The Chemical Institute of the Republic of Ireland has elected the following officers:—President, MR. J. L. GINNELL; vice-president, PROFESSOR T. DILLON; honorary secretary, MR. J. G. BELTON; honorary treasurer, MR. M. J. CRANLEY. Council: DR. V. C. BARRY, MR. H. L. O'REILLY, DR. D. O. TUAMA, MRS. E. M. PHILBIN, MR. F. T. RILEY, and MR. W. J. STRINGER.

The Council of the Institution of Chemical Engineers has awarded the Moulton Medal for 1951 to MR. C. J. STAIRMAND, of the Billingham Division of Imperial Chemical Industries, Ltd. Mr. Stairmand, who is in charge of the Small Particles Research Section at Billingham, was awarded the medal as a result of the presentation of his paper entitled 'The Design and Performance of Cyclone Separators' to the Midland Branch of the Institution. The paper summarised long-term investigation on gas cleaning by cyclones.

At the annual meeting of the Keighley Association of Engineers MR. JOHN C. BARWICK was not only elected president of the Keighley association for a second year but he was also unanimously nominated by the association for the presidency of the West Riding Engineering Federation. Mr. Barwick's engineering career started in the drawing office of Clapham Brothers, Ltd., gas and chemical engineers, and gas plant makers, Keighley.

MR. W. E. COOK, of Hagley, a director of Stuart & Sons, Wordsley, has resigned as secretary of the Midland section of the Society of Glass Technology. MR. N. HOWELL, of the British Heat Resisting Glass Company, Bilston, succeeds him.

On the 'Comet', BOAC's jet airliner, on 23 May will be MR. P. J. BOVILL, B.Sc., M.I.I.A., vice-chairman of the local board and general manager of the chemicals branch of Newton Chambers & Co., Ltd.

Mr. Bovill, accompanied by Mrs. Bovill, will be on holiday, but during his visit he will have a number of important meetings in connection with his company's business in East Africa.

Publications & Announcements

UNITS and standards of measurement employed at the National Physical Laboratory in its photometry, colorimetry and radiometry sections, are defined in 'Light,' published for the Department of Scientific and Industrial Research by HMSO, (price 6d., U.S.A. 15 cents). This is the second of a series of publications on units and standards of measurement, which so far comprises three separate pamphlets. The first deals with the fundamental units of length, mass and time, together with the derived units of volume, density, force and pressure. The third pamphlet gives an account of the electrical units and of the standards by means of which these units are determined and preserved.

* * *

A NEW type of glandless control valve which can handle high concentrations of abrasives suspended in liquids in addition to performing its normal function of controlling fluid flow is announced by Capri Patents, Wellington, Shropshire. The valve has no glands and no moving metal parts in contact with the fluid passing through it. An almost streamline flow through its body ensures that wear is reduced to negligible proportions. The valve can be provided to handle organic solvents and will be available in a range of sizes for all normal purposes and provided for either screw or flange fitting.

* * *

TECHNICAL notes in the April issue of the *F.P.A. Journal* (No. 17), published by the Fire Offices' Committee of the Fire Protection Association selected from a large number of queries received include precautions to be taken when handling zirconium, which is highly inflammable in the dry state and is explosive in contact with oxidising agents. The most effective medium for extinguishing fires in zirconium is not yet definitely established but they can be controlled by foam or sand. Other notes cover the hazards in processes where 'sponge' titanium is crushed, the risk of spontaneous heating in the storage of dry sugar beet pulp, and the danger arising from the contamination of oxidisable materials with chlorates and the high fire risk which may be associated with sacking contaminated with chlorates.

ALUMINIUM as an aid to horticulture is the main theme of *The Aluminium Courier* (No. 18, March, 1952) which shows that the metal has many distinct properties of interest to horticulturists. One prominent use, in which corrosion-resistance and light weight are equally important, is in irrigation equipment. A wide range of other applications from tools, ladders, barbed wire and light weight equipment for spraying insecticides to large aluminium-framed greenhouses, are described and illustrated.

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AN INTERESTING series brought out by the Cambridge Instrument Company is their Monograph series on prominent men of science who have been associated with the company. Dealing for the most part with the pioneer development of various scientific instruments that have had a marked effect on the progress of scientific achievement, the most recent issue to appear is No. 4, which deals with C. T. R. Wilson and the cloud chamber. The whole fascinating story of the discoveries that led to the development of this vital piece of apparatus are described, and many photographs included. The company constructed a special cloud chamber and exhibited it at the South Bank Exhibition last year, where it continuously produced nearly 6,000,000 sets of α-particle tracks for spectators in the Atomic Science Section of the Dome of Discovery.

* * *

GAY-LUSSAC, the great French chemist and physicist, before his death in 1850 expressed regret at having to go just when science was becoming so curious. Professor F. A. Paneth in his paper on 'The Trend of Inorganic and Physical Chemistry Since 1850' maintains that the study of inorganic and physical chemistry is just as fascinating as it was 100 years ago and that we are now witnessing the start of a new period in which the real fun is just beginning. Professor Paneth's paper, together with that by Professor A. R. Todd on 'A Hundred Years of Organic Chemistry,' are among the papers presented at the Edinburgh meeting of the British Association for the Advancement of Science and now reproduced in the March issue of *The Advancement of Science* (Vol. VIII No. 32).

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH IRON AND STEEL CORPORATION LTD., London, W. (M., 24/5/52). 10 April, charge, to Lloyds Bank Ltd., securing all moneys due or to become due to the Bank; charged on benefit of Industry Fund agreements. *—. 3 April 1951.

Increases of Capital

ALLEN AND HANBURYS LTD., from £850,000 to £1,000,000. Allied Colloids (Mfg.) Co., Ltd., from £15,000 to £40,000.

Company News

British Xylonite Co., Ltd.

Group trading profit of British Xylonite Co., Ltd., for 1951 was £1,213,879 (£955,782). Consolidated current assets £4,722,781 (£4,225,460). Current liabilities and dividends £1,395,509 (£1,018,130). Net current assets £3,327,272 (£3,207,330). Meeting 30 May, Mr. C. F. Merriam is chairman.

Glaxo Laboratories, Ltd.

The directors of Glaxo Laboratories, Ltd. announce an increase in the ordinary interim dividend from 7½ to 10 per cent in respect of the year ending 30 June next. For 1950-51 there was a second interim of 7½ per cent and a similar final making the annual distribution 22½ per cent. Sir Harry Jephcott is chairman.

Monsanto Chemicals, Ltd.

In his statement accompanying the report of the directors, Mr. E. A. O'Neal, Jr., chairman of Monsanto Chemicals, Ltd., states that the 1951 results of the company constitute a milestone in its progress, marking its evolution from a small business with growing pains into a medium size business with ambitions. The value of direct exports was 56 per cent higher than in the previous year and represented 33 per cent of the total turnover. Profit for the year after providing for taxation, depreciation and all charges was £919,033. A final dividend of 15 5/6 per cent is recommended making a total for the year of 22½ per cent. The report is accompanied by an illustrated supplement 'Serving Industry . . .' which briefly outlines the wide scope of the company's products and the industries which it serves. The 18th annual general meeting will be held at Winchester House, Old Broad Street, London, at 11.30 a.m. on 14 May.

Evans Medical Supplies, Ltd.

Net profit of Evans Medical Supplies, Ltd., Speke, Liverpool, after providing for taxation for the year ended 31 December, 1951, amounted to £196,386. A final dividend of 5 per cent, making a total for the year of 8 per cent, plus a bonus of 2 per cent is recommended. In his statement to to be held at the company's office, Speke, on 14 May, the chairman, Mr. Ian Fergusson, mentions the increase of nearly 55 per cent in overseas trade. He also registers a protest against the penal levels of taxation and referring to the National Health Services, claims that if all the drugs and medicines were supplied without profit and with non-return on capital invested in the pharmaceutical industry, the total cost to the service for 1951/52 might have been reduced by about £1,500,000. The report is accompanied by a booklet entitled 'Review of 1951'.

F. W. Berk & Co., Ltd.

The penalising effect of present taxation which gives no encouragement for industry to expand is referred to by Mr. A. D. Berk, chairman, in his circulated statement prior to the annual general meeting of F. W. Berk & Co., Ltd., which will be held in London on 6 June. Despite the successful response to a request for additional capital in 1950, a temporary loan had had to be obtained for further finance. Effects of Government bulk buying and restrictions imposed prevented the company from using its experience in trading to the best advantage. Nevertheless, the company had had a very successful year in which sales of the group had expanded in value by about 60 per cent over the previous 12 months. Two interim dividends of 1½d. and 2½d. per share had already been paid, and a bonus of 1d. per share (less

[continued on page 806

income tax) was proposed as a final distribution for 1951. In future, the directors expected to pay only one interim dividend, profits permitting, in December.

Distillers Company Issue

Applications numbering some 42,000 and totalling £164,000,000 were received by the Distillers Co., Ltd., for its issue of £10,000,000 5 per cent Unsecured Loan stock at par. The directors have decided to allot about £9,250,000 of the stock to the company's stockholders and staff. In determining the allocation to the ordinary stockholders, regard has as far as possible been given to the amount of the individual registered holding of the applicants. The balance will be allocated to the public by ballot.

Next Week's Events

MONDAY 26 MAY

Incorporated Plant Engineers

Leeds: University, 7.30 p.m. West and East Yorkshire Branch. A. G. Dewhirst: 'Plant Re-organisation'.

TUESDAY 27 MAY

Society of Chemical Industry

London: Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 6 p.m. Joint meeting of the Agriculture Group with the Plastics and Polymer Group. Dr. D. T. Mowry (Central Research Department, Monsanto Chemical Co., Dayton, Ohio, U.S.A.): 'Improvement of Soil with Synthetic Polyectrolytes'.

Society of Instrument Technology

London: Manson House, Portland Place, W.1, 6 p.m. Annual general meeting.

WEDNESDAY 28 MAY

Royal Institute of Chemistry

London: Milwall, 2.45 p.m. London and South-Eastern Counties Section, visit to the Associated Lead Manufacturers, Ltd.

THURSDAY 29 MAY

Incorporated Plant Engineers

Sheffield: Grand Hotel, 7.30 p.m. South Yorkshire Branch. P. McA. Martin: 'Foundry Mechanisation'.

FRIDAY 30 MAY

Incorporated Plant Engineers

Birmingham: Imperial Hotel, 7.30 p.m. A. G. Curgenven (York Shipley, Ltd.): 'Refrigeration'.

To Produce Steel Valves

THE APV Company Ltd., of Wandsworth Park, London, will use the processes and technical data of the Cooper Alloy Foundry Co., of Hillside, New Jersey, U.S.A., for the manufacture of stainless steel valves, the Mutual Security Agency Mission to the U.K. announced on 16 May.

Cooper is a leading producer of stainless steel, nickel and monel valves for the processing and manufacturing fields. The firm will furnish designs, engineering and production drawings, as well as information on techniques and procedures for the manufacture and use of valves used in the processing of chemicals, brines, petroleum, explosives, paper and other products involving corrosive and hazardous liquids and gases.

The American firm agreed to make this technical data available to APV under a 10-year licensing agreement, with royalties to be paid for all valves produced with Cooper processes and sold or used by APV during the period.

The guaranty was approved by MSA as furthering the common interests of the U.S. and other free nations. Use of corrosive-resistant valves is expected to result in safer and more economic processing of vital materials in numerous important industries.

APV sales of stainless steel valves are expected to reach a volume of from £100,000 to £150,000.

Dissolution Ordered

APPEAL to the United States Supreme Court is possible on a Federal Court judgment ordering the dissolution of a world cartel in munitions, arms, chemicals and nylon. The order prohibits Imperial Chemical Industries, Ltd., E.I. Du Pont de Nemours, Inc., and the Remington Arms Co. from dividing territory and allocating customers and markets 'so as unlawfully to limit the commerce of the United States'.

Mr. John Rogers, chairman of Imperial Chemical Industries on Saturday said: 'It is nothing other than we expected, and it will not adversely affect I.C.I.' He could not say what action I.C.I. would take. If there were no appeal the court would expect the firms to put up some scheme for preventing such things happening again. It might be necessary to submit several schemes before the court would be satisfied.

Market Reports

LONDON.—New business on the industrial chemical market during the past week has been on a fair scale and delivery specifications against existing contracts have covered good volumes. Market conditions so far as textile and kindred chemicals are concerned have shown little change. Further price reductions for the chemical compounds have been announced following the fall in the price of pig lead. The basis price for red lead is now £154 per ton and for white lead £165 per ton. The price of antimony metal has been reduced by £35 per ton and the new price range for antimony sulphide is 2s. 4½d. to 2s. 11½d. per lb. for the golden and 3s. 6d. to 4s. 8½d. per lb. for the crimson.

MANCHESTER.—The main price changes reported on the Manchester chemical market during the past week have been further reductions in the lead compounds resulting from the fresh fall in the metal and cuts in certain solvent materials. Otherwise, values have been maintained at around their recent levels. Textile chemicals are mostly meeting with a reduced demand still, but the call for most other lines keeps up fairly well and a steady movement of supplies on export account continues. In the fertiliser section there is a fair inquiry for superphosphates and the compounds, and a steady trade is being done in most tar products.

GLASGOW.—There was a slight falling off in demand over the past week. However, it was by no means an unsatisfactory period. The demand for export is still quiet.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

ASSISTANT CHIEF CHEMIST required for Tar and Benzole Refinery near Manchester. Aged about 30-35, with University Degree or equivalent. Previous experience in the industry desirable. The post involves control, under the Chief Chemist, of the Works Laboratory. Write, stating age, qualifications, experience and salary expected, to **BOX NO. C.A. 3147, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.**

CHEMICAL ENGINEER. THE MIDLAND TAR DISTILLERS, LTD., OLDBURY, NEAR BIRMINGHAM, require a fully qualified Chemical Engineer with several years' experience in industry. Age 27-35. Salary according to age and experience. Contributory Pension Scheme in operation. Applications to PERSONNEL MANAGER.

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